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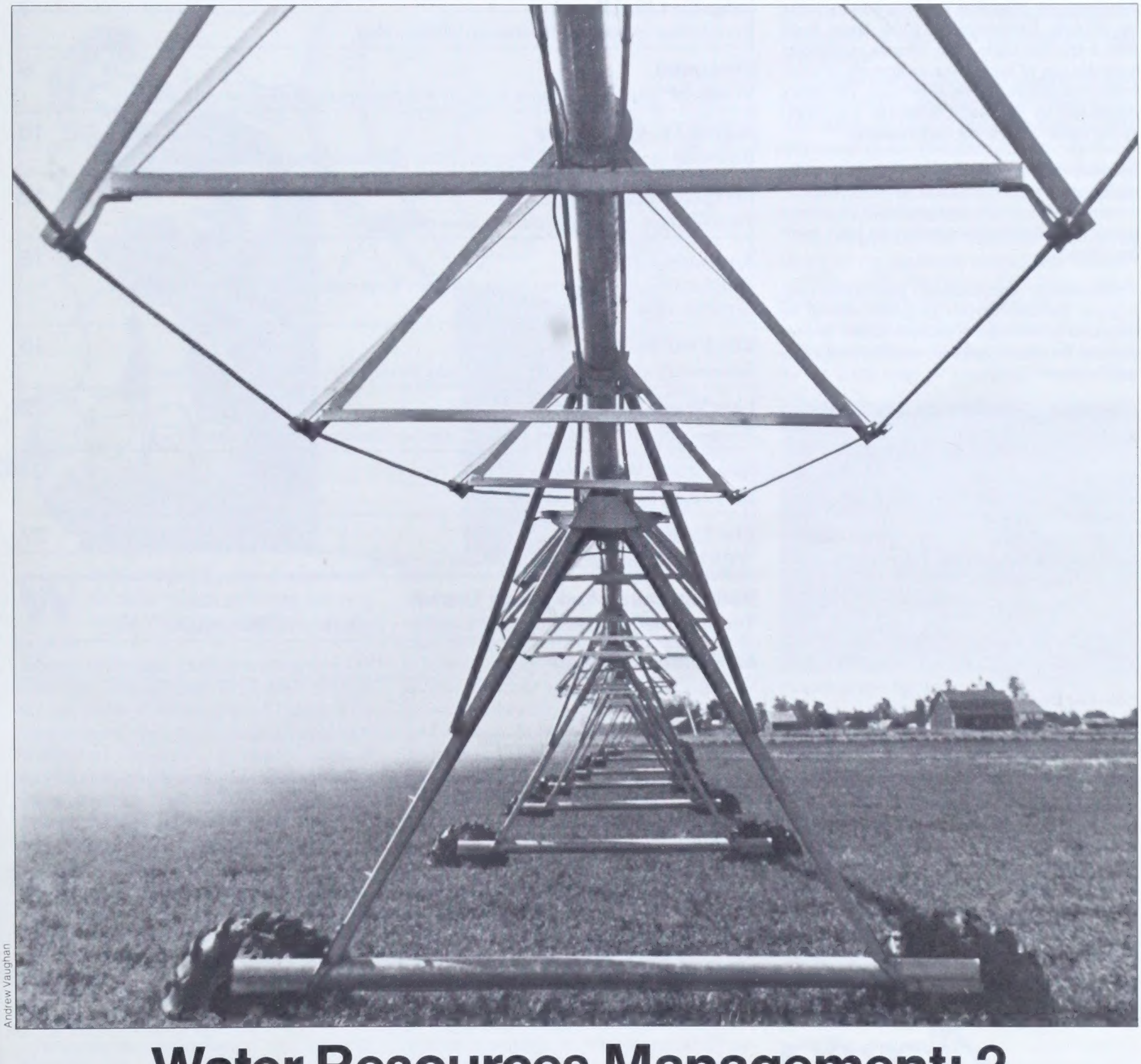

Andrew Vaughan

Water Resources Management: 2

ISSN 0701-9637

ENVIRONMENT VIEWS

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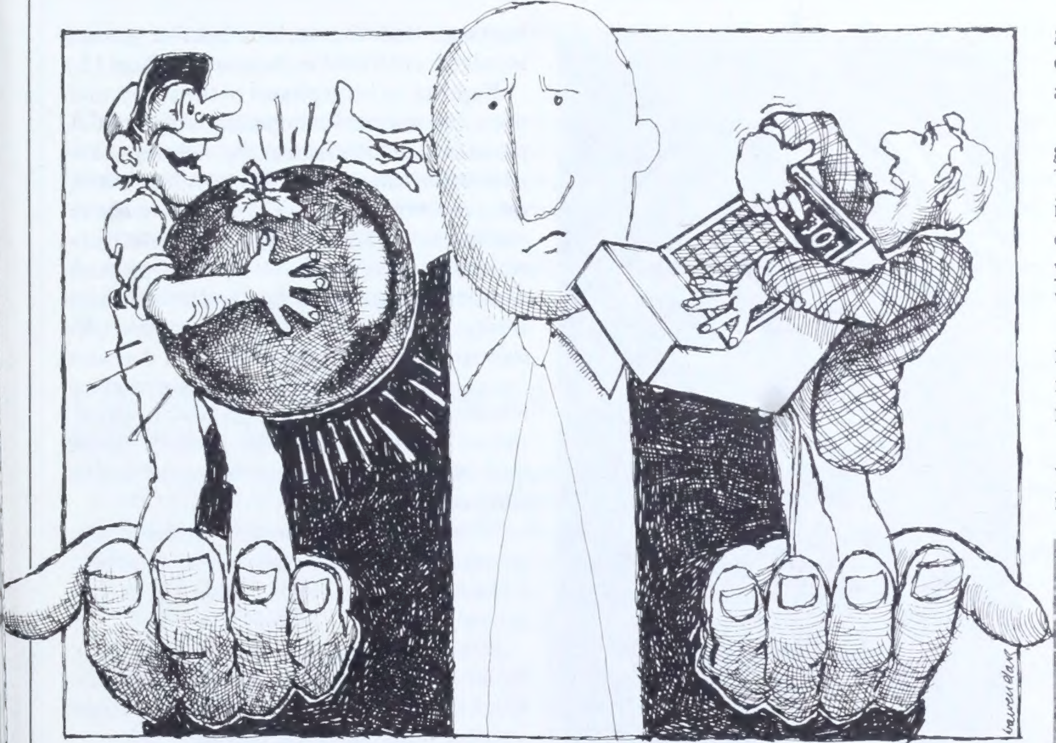
Alberta
ENVIRONMENT

Introduction: Gillian Sniatynski

Irrigation In Alberta

What are the benefits? What are the costs?



When widely different groups want to make widely different use of a single resource, conflicts are inevitable.

Some of the user conflicts relating to water resources management were dealt with in the last issue of *Environment Views.* This issue concentrates on the largest water user in Alberta — irrigation. It considers some of the effects of irrigation development on other water users, and on the province generally.

First, an important clarification: irrigation is the largest user in terms of water *consumption.* While other water users, for example municipal water plants, also make big withdrawals from our rivers and streams, most of that water is returned to its source, after treatment at a sewage treatment plant. Water that's withdrawn for irrigation — about 83 per cent of the total consumption — is lost to the river forever.

What are the implications of this consumption? The major one concerns the simple law of supply and demand: when large amounts of water are permanently withdrawn, other users have to make do with reduced volumes. This may be inconvenient and unfair for users such as recreational fishermen — it may be a matter of life and death for the fish. Water licensing, as the story on Page 10 shows, attempts to arbitrate the rights of various water users and ensure a fair supply for everyone. But the fact remains that most of the licensees want their water for irrigation purposes.

The assumption must be that, in spite of the imbalances it creates in the water system, irrigation is still the best possible use of that water. And as the story on Page 12 notes, there are different shades of opinion on that issue.

An estimated 400,000 hectares (one million acres) are now under irrigation in the province, about 90 per cent of that area in the Oldman River basin in the south. For 1978, this represented 3.38 per cent of the total crop acreage in Alberta, and 8.29 per cent of the total value of crop production. Wheat, barley and alfalfa hay are the major irrigated crops in terms of acreage, but other grain and forage crops, oilseeds and specialty crops such as vegetables and sugar beets are also grown.

Statistics illustrating the benefits of irrigation for crop production are persuasive. The tables on Page 7 show both the greatly increased yields possible, and the diversity of crops that can be grown. But the big yields and the specialty crops aren't possible without some tradeoffs.

Because of the wide seasonal variation in flows of the southern rivers, regulation is necessary to capture some of the heavy spring flow and store it for summer use.

The regulatory mechanism may be a dam, with an onstream storage reservoir behind it. Or there may be pumping stations and canals diverting water to an offstream storage site — perhaps a specially built reservoir, or perhaps an already existing lake. Whichever option is chosen, the fact remains that regulation alters the natural regime of the river, with a variety of environmental consequences.

Andrew Vaughan

A dam with an onstream reservoir means the flooding of a river valley, and perhaps loss of wildlife habitat or useful farmland. It usually means reduced downstream flows, which may seriously affect fish populations. There are implications for recreation too: an onstream reservoir may provide great sport fishing and safe swimming, but it probably puts paid to canoeing.

Offstream storage may be a "softer" option environmentally. Diversions work for the duration of the heavy spring flows, then the river reverts to its normal flow pattern. The diverted water might have a beneficial effect, such as providing a place for water recreation where none existed before. On the other hand, there might be just as much damage in terms of flooding as with onstream storage, depending on the site that's chosen.

It's true of course that storage reservoirs are required for reasons other than irrigation. But in the southern part of the province, particularly the Oldman River basin, it's for irrigation that they are mainly required. And demands for irrigation water supplies have increased to such an extent that, if irrigation farming is to continue and expand, a means must be found to provide more water.

Six years ago, the minister for environment initiated the first phase of a study of water resources and their use in the Oldman River basin. That study was followed by a second phase which among other things considered additional water supply alternatives and responded to demands for information from the public. The Environment Council of Alberta (ECA) then (in November, 1978) conducted public hearings on the issue. (Details of the studies and hearings, and the various interest groups involved, are found in the story on Page 15.)

Corn growing under irrigation.

Alberta Government Photo

Reports on both phases of the study, and the report and recommendations of the ECA panel which conducted the hearings, are now before the cabinet. It's possible that by the time this issue of *Environment Views* reaches its readers, a long-awaited decision will have been made — perhaps to start work immediately on a dam and an onstream storage reservoir, perhaps to increase offstream storage, perhaps to *defer* a decision on major new headworks in favor of further rehabilitation of the systems now in place. (More details about some possible future developments in irrigation appear in the story on Page 30.)

Whatever the government decision, the six years of study have given a lot of people a chance to speak their minds about irrigation.

Most people in irrigation country think the benefits outweigh the costs. The Oldman River Study Management Committee's final report summarizes their position:

"The proponents of irrigation in the

A look at the history of irrigation in the province gives a better perspective on the role the government now plays.

The Oldman River basin area in the south was relatively unsettled until the completion of the transcontinental railway towards the end of the 19th century. It was clear that agriculture without irrigation would be risky, and several small private schemes were set up.

But the era of irrigation really began in the 1890s, when the railroad companies started development of the tracts of land they had been granted as subsidies for building the railroads. The companies wanted to increase the value of the land, and use the increased agricultural production as freight for their systems. A group of British financiers also organized a company to develop a large irrigation scheme near Vauxhall.

As well as these ventures, several smaller irrigation projects were set up from 1915 to 1930 by the farmers themselves. During the depression of the 1930s, most of these projects ran into difficulties and needed government help to keep operating.

The government also stepped in in the late 1940s and early 1950s, when the St. Mary's River development and the Bow River development were built as joint federal-provincial ventures.

The private schemes were gradually taken over by the water users themselves and formed into irrigation districts. Today there are 13 of them, quasi-municipal bodies which operate under the Alberta Irrigation Act. This act gives the districts the right to elect a board of directors, appoint a manager, and to levy and collect charges for the delivery of water.

Water rates vary from district to district: one charges farmers $8.10 per acre annually irrigated; a smaller district charges $1.75. In addition, when a new user joins the district, he must pay a once-only "water right" (which ranges from $50 to $5 an acre) as a contribution to the capital assets of the district.

That's usually enough to cover the day-to-day operation and maintenance and administration of the district. But the problem is that irrigation structures — the dams, ditches, canals and so on — have a limited life expectancy, and many currently need rehabilitation or replacement. These costs would be beyond the farmers' means, so there's a strong moral imperative, as there was in the depressed 1930s, for the government to step in.

A study in the 1960s to examine the work to be done and recommend a cost-sharing formula set the water users' contribution at 14 per cent and the government's at 86 per cent.

ENVIRONMENT VIEWS

Teacher/Student Guide: Water Resources Management: 2

This guide accompanies *Environment Views* volume 3, number 3 on the aspects of water resources management related to irrigation.

Prepared by Susan Washington, environmental education co-ordinator, Alberta Environment, and Bob Mills, a Red Deer teacher.

CANADIANA
JAN 23 1981

> *"When water chokes you, what are you to drink to wash it down?"*
> Aristotle

The advantages and disadvantages of contrasting positions about irrigation provide a focal point and raise some value questions for students to begin to understand the complexity of water resources management and industrialization in Alberta.

This guide is organized into two sections.

I. Questions on articles: This section provides the student with a literature review on the topic of irrigation.

II. Applications to the local area.

I. QUESTIONS ON ARTICLES

Irrigation In Alberta

1. Before examining the question of water supply for irrigation, a number of basic considerations should be analyzed. Using the following headings, list the items in each category you think should be researched before an irrigation project goes ahead:
   - soil type;
   - source of water;
   - water quality;
   - terrain;
   - present use;
   - projected use;
   - economic impact;
   - sociological impact;
   - long-term effect;
   - environmental impact;
   - impact on others;
   - political considerations.

   Once you have done this itemized list, work through the articles; compare your analysis before and after.
2. What are the major concerns of a) onstream reservoirs or b) offstream storage?
3. What would the cottage owner on a lake chosen for offstream storage be most concerned about?
4. According to Stanley-SLN Consulting Ltd., the consulting firm which examined some of the economic aspects of the Oldman River studies, estimates are that it will cost the government $500 million for expansion of the irrigation districts. That is taxpayers' money to support a small sector of the provincial rural economy.
   a) What is meant by this phrase?
   b) Do you think the cost is worth it?
5. According to Dr. Arnold Platt, one of the major problems of specialty crops is which comes first, the market or crops. What is your opinion on this question? Give at least two reasons to support your position.
6. One of the major overriding problems in Alberta is that most of the water is in the north of the province while the big demand for water is in the south. How might this problem be solved? What are some of the implications of your solution?
7. Trace back as far as possible the development of irrigation in Alberta. After outlining the history, project the availability and use for the next century. Be sure to note changes in technology, and allow for unforeseen developments.

Teacher Note: *A line graph may be a useful technique for students to use in charting the broad perspective.*

Rights To A Resource

1. Will adequate licensing of flow affect the water table and/or long term needs of an area? Be sure to state the criteria you used in reaching your conclusion.

Research Questions:

2. How can water licensing affect water quality?
3. What effects can water licensing have upon the ecological community?

Teacher Note: *Any science book discussing water will have information on the ecological impacts from the effects of water use.*

Perspectives On Irrigation

Teacher Note: *Irrigation farming raises many serious questions. The following pose some of these:*

1. Have students discuss the pros and cons of the following:
   a) Arable land near cities is used for growing urbanization and industrial development. This development could be placed on less arable land, often not as convenient. The cost for this type of development is similar to developmental irrigation costs on marginal lands in southern Alberta.
   b) Soil conservation management is critical if our farmland is to remain productive.
   c) Marginal land can be used to produce food, it just takes more of it.
   d) If we increase irrigation we can solve our long-term projected food shortage.
   e) Development of better watershed management practices in the mountains and foothills (i.e. reforestation, snow collection, etc.) is critical to slow down run-off in the spring. This may reduce the need for major dam projects to retain run-off.
2. Is it in the public interest to support some farmers, through publicly funded irrigation projects, and not others? Discuss in a paragraph.
3. Many major concerns can be raised when a dam is proposed for a river. Following are a list of concerns: priorize them from

most important to least. Be able to justify your arrangement.

a) Loss of a beautiful river valley (aesthetic concerns);
b) loss of productive farmland;
c) wildlife damage;
d) recreation potential;
e) cost-benefit analysis;
f) more water for irrigation by a controllable flow;
g) diversification of an area (i.e. industrial uses);
h) alternative methods of water storage;
i) relocation of farms.

4. Do you see a potential imbalance between short-term gain and long-term consequences when discussing the irrigation question? In essay form give at least three supporting reasons for your position.

Less Waste Means More Water

1. List the ways irrigation systems can be made more efficient.
2. Where should funds come from to accelerate research in maximizing efficiency in irrigation systems: the farmer, provincial government, federal government? State the reasons behind your answer.
3. What considerations, other than efficiency of delivery, need to be addressed when discussing irrigation? Why are these considerations important (or unimportant)?
4. Irrigation districts are often touted as participatory democracy at work. Yet many farmers find themselves in a confrontation with their neighbors over water allocation. How would you administer a water allocation system to ensure maximum efficiency and equitable allocation? How much input should individual farmers have in management? How should the cost of water to an irrigation farmer be determined?

New Ways With Water

1. What would be the advantages of developing irrigation technology in Alberta?
2. On a chart list the types of irrigation equipment described. In point form list the pros and cons of each.

The Energy Factor

1. Irrigation farming is a high energy user. If for some reason there was a major energy shortage which types of irrigation systems would be affected? Describe what kind of impact such a shortage would have on the farmer and consumer.
2. As fuel costs continue to escalate, what alternatives do you see for irrigation in Alberta?

The Cost To The Environment

1. One of the questions posed from the Colorado River story is: Will the continued investment in intensive irrigation produce short-term economic gain at the expense of the public interest or will it lead to the wellbeing of future generations? What is your opinion? In two paragraphs state the criteria you used to reach your conclusion.
2. As the demand for water increases, the difficulty in satisfying everyone's need arises. The Colorado River situation is a good example of this. Could you foresee a similar problem arising between Alberta and Saskatchewan? If so, how would you recommend the water be dispersed in case of a dispute? Hint: Alberta and Saskatchewan do have a water agreement which ensures Saskatchewan will receive 50 per cent of the average river flow.
3. Excessive salinity in the soil is one of the major problems associated with massive irrigation projects. To show the effects of salinity in plant growth set up the following experiment:

Materials: Seeds (bean, radish), five cardboard milk containers with the tops removed, salt (NaCl), marking pen, soil.
Prepare the milk containers, place soil in and then label them 1 to 5.

- Sow approximately 10 seeds in each container, following exactly the same procedure for each.
- Prepare four different salt solutions, varying from a trace to a stronger concentration. (Don't make the salt solutions *too* strong.)
- For each watering, use the same amount of water for each container.
- Water the four containers with the solutions, making sure you have labelled the containers to match the concentrations of salt used. The fifth container should be watered with pure water.
- After several days the seeds should begin to germinate and within 10 days you will be able to observe major effects in plant growth.
- Chart the plant growth for one week.
- With subsequent waterings you might increase the levels of salt fed your plants and observe the changes in growth.

4. Why are house plants subject to salt build-up in their soil?
5. What types of testing should be done prior to an irrigation project beginning?

Speaking Up

1. What sorts of trade-offs should be considered when discussing a dam on a river?
2. A large percentage of the specialty crops produced in Alberta is grown on irrigated land. Irrigation is a consumptive user of southern Alberta's limited water. Can the economy, and the farmers, get along without irrigation and use the water for other purposes?
3. Continual exploitation of water for irrigation often creates conflict with the management of other resources in an area. Find examples of this in your area and give possible alternatives to such conflicts.
4. Carl Primus from Alberta Environment poses the question: "How do you attach a dollar value to a third or fourth generation farmstead?" (The government solution is to have two assessments to evaluate the fair market value of the land for expropriation.) In a short paper, discuss this dilemma.

Role Play Situation

Teacher Note: *Simulation games, coupled with serious library research done by students, can be an excellent tool for outlining the issues in environmentally complex sensitive issues.*

The Problem: Because of projected irrigation needs, public pressure, conflicting demands, estimated energy needs, and government interest, ECA hearings are being held to consider the possibility of building a dam on a river in southern Alberta. Viable farmland and a beautiful river valley will have to be flooded for the dam. Presentations on this are being heard and the ECA will present its own recommendation to the minister of environment, who will then bring this matter to cabinet for decision.

Assign students to the following groups:

1. Provincial fish and wildlife officials and the Fish and Game Association who are concerned about fish population levels and wildlife habitat.
2. Coalition of conservation groups concerned about the development of canals and reservoirs.
3. Irrigation district representatives who see a need for more irrigated areas.

4. Association of contractors who do the actual building of the reservoirs and canals. Some of these are area residents.
5. Irrigation farmers who expect to benefit from the new reservoirs.
6. Dryland farmers who are looking to increase production and develop profitable specialty crops through irrigation.
7. Dryland farmers who expect to lose some or all of their land because of headworks or flooding of their land.
8. Dryland farmers who are not directly affected by the decision.
9. Local chamber of commerce representatives who see increased business because of equipment needs from more irrigation farmers.
10. Member of the archeological community concerned with potential loss of important archeological sites along the river.
11. A municipality downstream from the proposed dam site concerned about water flow, quality and availability.
12. A tribal council in the area on whose land some of the headworks may be located. They are concerned about jobs, but also the social and cultural disruption of their lifestyle.
13. Students from local high schools who are making a presentation on behalf of their class.

Have all the groups, through library research, prepare their testimony. Teacher and students can sit as ECA members to evaluate the proposals. This groups should meet to determine time limit of presentation and other ground rules. Make sure that all members of the ECA panel know that their recommendations can be different from those of the chairman. After the presentations, give the ECA panel time to form its recommendations and announce them to the class, along with its reasons.

Follow-up:

As a class discuss whether this hearing process is democratic and available to a fair representation of the public.

Building Dams And Fixing Ditches

1. As you read this article, identify the differing values. As a class discuss what the differing positions are.
2. Individually answer the following: Will the different value systems presented in this article come into conflict more often in the future? Why, or why not? Compare answers in class.
3. Is such a conflict limited to water resources management?
4. Is the massive amount of money necessary for the rehabilitation of irrigation systems in Alberta a good investment?
5. What are some of the problems associated with the diversion of water from one river basin to another?
6. Evaluate interbasin transfer as it relates to:
   - engineering feasibility;
   - economic advantages;
   - environmental impact;
   - sociological impact;
   - political considerations.

Summary

In a democracy, information from all sources has value. To identify issues and determine accuracy it is important to develop critical thinking skills when reading and listening. One effective way is to compare information sources, and references. Another is to analyze articles you read to determine if there are hidden values or biases that are presented. The following questions are posed to help students develop critical skills.

Analyze the articles in this issue of *Environment Views:*

1. Cite other sources of information which authors might have written (or called) for more information.
2. Determine if any of the writers' or editorial board members' values on water resources management are reflected in the issue, and, if they are stated or inferred, where they appear in the issue.
3. State, giving at least three reasons, whether or not you think *Environment Views* is well-researched coverage of the irrigation aspect of water resources management.
4. Does this issue mean anything to you? Why, or why not?

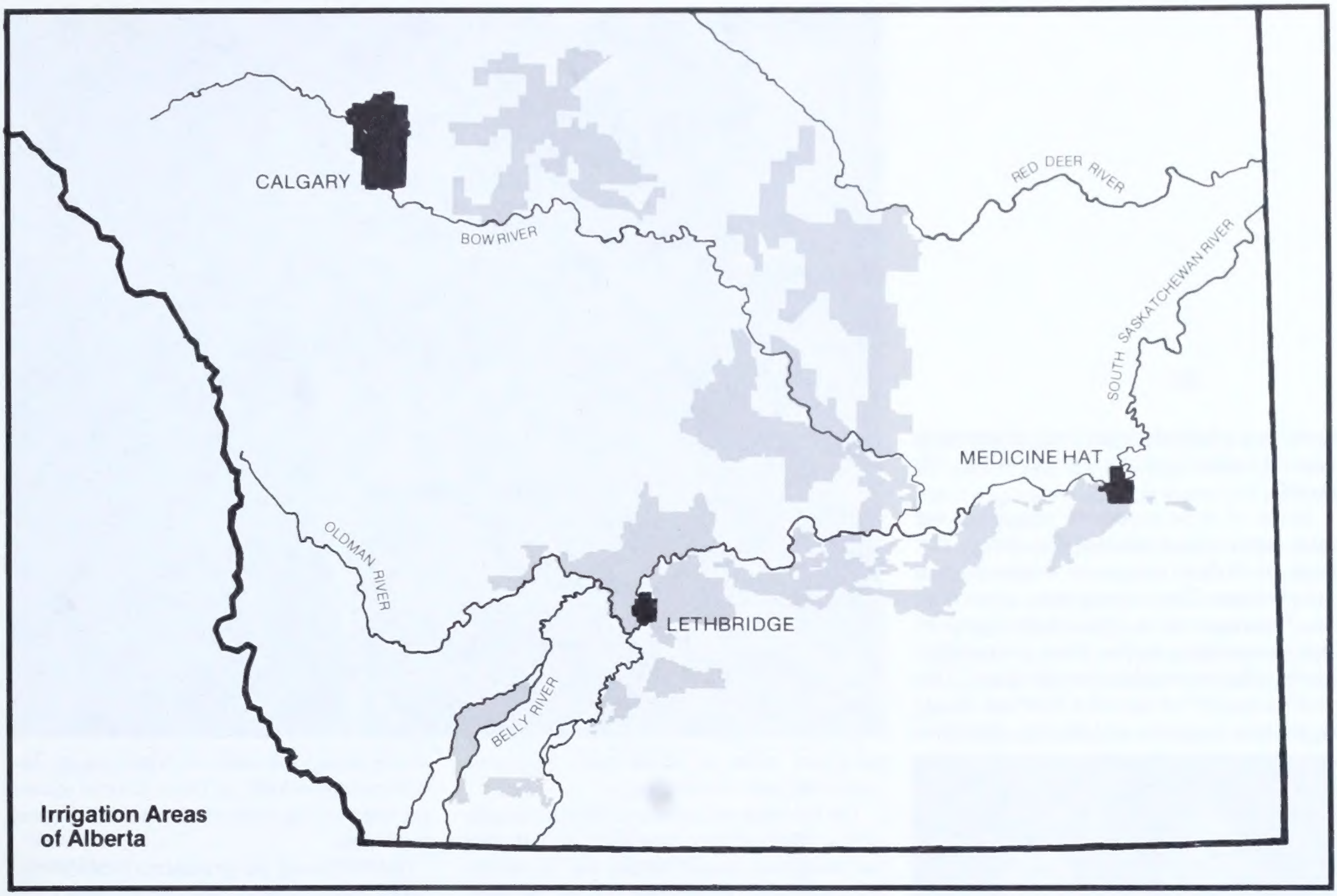
Send in responses to this question to the Environmental Education Co-ordinator, at:

Alberta Environment,
Communications Branch,
9820 - 106th Street,
Edmonton, Alberta
T5K 2J6.

II. FIELD STUDIES

Application To Local Area

1. Make a study of the water supply in your area.
   a) What is the source?
   b) Is the source expected to meet future needs?
   c) Have there been any changes in water use needs in your area in the last five years?
   d) Are water resources being wasted in your area? If so, how?
   e) Are there possible alternatives for water conservation in your area?
   f) Are there major proposals for projects which will dramatically change the use of water in your area?
   g) Compare your research through class discussion.
2. The effects of salinity can be observed by a visual inspection of farmland. Where there are white patches on the soil, it is due to a salt build-up. You will notice a definite effect on plant growth. Compare plant growth on two sites, one with saline soil and one with normal soil.



Oldman River Basin include: irrigation farmers, irrigation districts, commodity groups, farm organizations, chambers of commerce, irrigation communities, municipalities, Indian bands and residents outside of the headwaters of the basin . . .

"These groups believe that southern Alberta's favorable climatic conditions, its productive soils, and its water supply provide the province with an opportunity to expand its food producing capability, diversify its food production to obtain a larger share of the domestic market for certain products (forage for dairy and beef production and beef finishing, oil seeds, sugar beets, corn, beans), expand its export markets, provide reserves of forages and feed grains for drought periods, and provide opportunities for development stemming from or induced by irrigation. These groups contend that such economic diversification would provide economic stability for southern Alberta and contribute to balanced economic development throughout the province."

There are those, however, who have some reservations about irrigation. Some are concerned about the heavy demands made by irrigation on water supplies, and the damage to land from salinization that frequently results. There are situations in the United States for example, that give good grounds for concern. The story on Page 18 deals with the tragically diminished Colorado River, and the extent of salinization in Alberta.

But most of those who oppose any expansion of irrigation in southern Alberta do so, like Dr. Terry Veeman whose Viewpoint article appears on Page 9, on economic grounds. Irrigation farming is an expensive business, so expensive that even in spite of heavy expenditures by individual farmers, substantial government subsidies are still needed.

Conservative estimates by Alberta Agriculture set the government's contribution to irrigation in the Oldman River basin at about $33 million from 1950 to 1977.

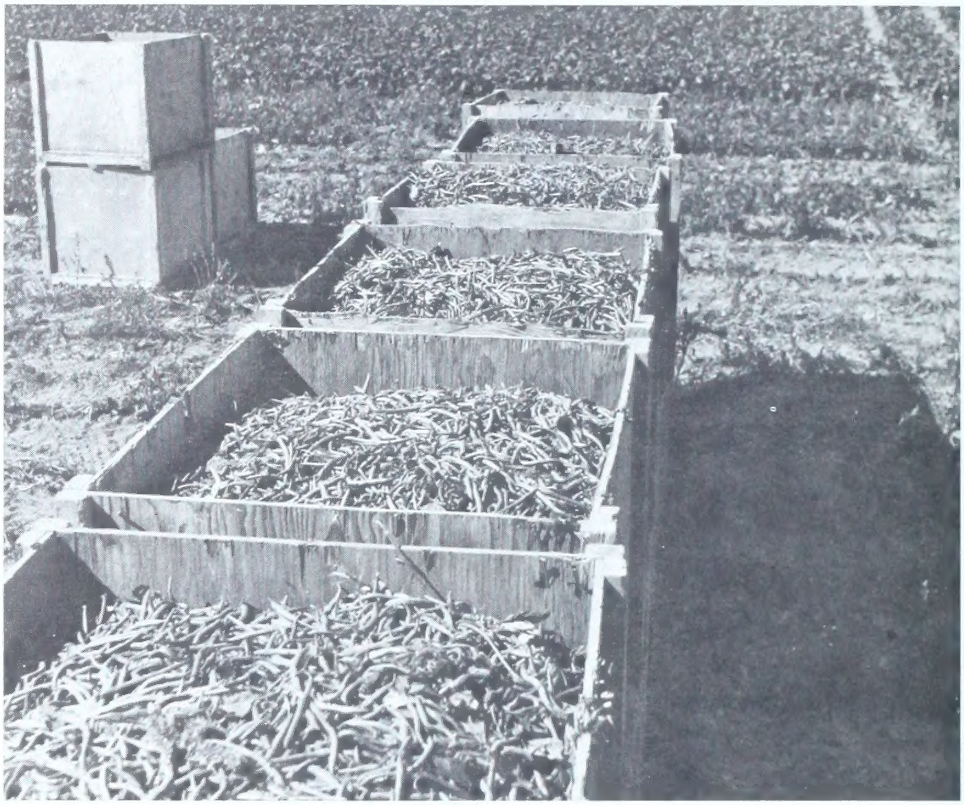
And those expenditures are increasing: $200 million from the Heritage Savings Trust Fund has already been scheduled to be spent in the basin in the 1975-85 decade for rehabilitation of headworks and distribution systems, more water storage, expansion of existing irrigation districts and the irrigation of new acreage. Estimates set the cost of irrigating new land at about $2,500 a hectare — and that figure, say some experts, is probably on the low side. A new dam would mean even more money.

Stanley-SLN Consulting Ltd., which examined some economic aspects of irrigation as part of the second phase of the studies, concluded that the government's bill will more likely be $500 million than $200 million. That's a lot of taxpayers' dollars to support what is still a relatively small sector of the provincial rural economy. Is it worth it?

Those who think not, according to the management committee final report, include fish and game associations, nature protection organizations, academics, residents at proposed onstream storage sites, and residents in communities and municipalities within the headwaters of the basin.

They feel that "the use of Alberta Heritage Savings Trust Fund monies on projects that benefit a small percentage of farmers and businessmen constitutes an unjustifiable subsidy to a select few and is not a beneficial investment for Alberta as a whole. These groups are of the opinion that increased agricultural production will lead to greater surpluses, additional marketing problems, and ultimately reduced prices and lower returns to the producers . . ."

They expressed concern that "crops produced under irrigation are in direct competition with crops produced on dryland (grains and pasture), and that government subsidies give the irrigation farmer an unfair economic advantage, thus generating bad feeling between the two groups of food producers." Zonal inequalities in funding are an associated concern: with all that money being



Alberta Government Photo

spent in a relatively small area of southern Alberta, what's left for agriculture in the north?

Some of these economic arguments are more convincingly rebutted than others. The issue of dryland-irrigation competition is one of them. The management committee was "encouraged to note a high degree of complementarity rather than competition between the two modes of production." This year's drought has caused a shortage of hay in western Canada, and it's the irrigation farmers who are saving the day by having it to sell to dryland ranchers. Likewise dryland farmers supply barley and other feedgrains for livestock kept in irrigated areas.

Alberta Government Photo

Crops such as barley which can be grown on dryland and under irrigation may create competition in times of limited markets. But, says Dr. Arnold Platt, chairman of the ECA panel that conducted the public hearings, "all farming is competitive — that's why farmers are poor!" At his sheep ranch near Spring Coulee, Platt says he too was glad of the irrigated land nearby as a source of feed this spring.

Platt and Cy McAndrews, assistant deputy minister for development with Alberta Agriculture, both note that the irrigated crops of the future — those that will likely sell best — are soft white wheat, corn for livestock feed and distilling, oilseeds and sorghum, most of which can't be grown under dryland conditions.

On the issue of zonal distribution of subsidies, McAndrews concedes that money for irrigation means money for the south. He points out though that funding for agricultural development has traditionally followed the trail of population growth from east to west nationally, and from south to north provincially. It's only politic, after all, to spend money where the people are. But "the potential for development will move north, and will occur, and the investment will be made."

McAndrews notes, too, that there *are* some agricultural expenditures in northern Alberta: $25 million to develop community pasture; other funds for drainage projects; subsidies for land clearing, and so on. And investment in the north in development other than agriculture is certainly being made: what's $200 million on irrigation, one might ask, compared with billions on the oilsands plants?

The question of markets for irrigation produce is another matter for debate.

Irrigation makes possible the production of various specialty crops, like sugar beets and vegetables, that wouldn't otherwise be available. And it wouldn't take too many acres to satisfy the local market for vegetables like carrots or potatoes that can be stored during the winter. But according to Russ Marfleet, secretary-manager of the Alberta Potato Commission and the Alberta Fresh Vegetable Marketing Board, only about 60 per cent of the local market is being supplied from local sources, because there aren't enough adequate storage facilities. The deficit is trucked in from United States growers, along with our winter lettuce and tomatoes.

Burns Wood, the president of the Alberta Sugar Beet Growers' Association, feels sugar beet production could be greatly increased, and "it's wasting a resource if we continue to neglect raising three times as much as we could." But more can't be produced and sold until the province's refining capacity is increased. The single plant at Lethbridge may not be enough to ward off competition from the big B.C. sugar producers.

"One of the problems of specialty crops is which comes first, the crop or the market," says Platt (who also acts as a consultant on agricultural markets, among other areas of expertise.)

"We could produce enormous amounts of soft white spring wheat. It's a fast-growing crop, and our only opposition is in Washington and Oregon and some in Australia. But we haven't produced enough to develop the market, not more than trial shipments — which have been well received."

Platt sees the vegetables and sugar beets as playing a minor role in the future of irrigation farming. Other crops have much better potential — and seemingly ready markets.

"We could produce lots of corn, for livestock feed and for distilling. It's an excellent feed and the better farmers are now getting a very good yield.

"There's the whole oilseed complex which looks very promising. For just about any oilseed crop you can grow the markets are

Comparison of Irrigated and Dryland Crops Yields, Alberta, 1978

Commodity	Average Yield Irrigated	Dryland	Difference in Yields	Percent Increase in Irrigated Yield Over Dryland Yield
Principal Grains	(Bushels)	(Bushels)		
Wheat	53.5	21.0	32.5	154.76
Oats	80.0	45.0	35.0	77.78
Barley	72.5	40.0	32.5	81.25
Oilseeds	(Bushels)	(Bushels)		
Flaxseed	23.5	14.0	9.5	67.86
Rapeseed	37.5	15.0	22.5	150.00
Forages	(Tons)	(Tons)		
Hay	4.0	1.3	2.7	207.69

1 Source:
Irrigated Crops Grown by Irrigation District, 1978
Alberta Department of Agriculture, Economic Services Division, Lethbridge

2 Source:
Agriculture Statistics Yearbook, 1978, Statistics Branch, Alberta Department of Agriculture

Value of Irrigated Crop Production, Alberta, 1978

Commodity	Production	Unit Price	Value of Production	Percentage of Provincial Value of Production
Principal Grains	(Tonnes)	(Per Tonne)		
Wheat	247,481	122.40	30,291,674	6.0
Oats	14,798	62.80	929,314	[illegible]
Barley	259,699	73.35	19,048,922	5.2
Mixed Grains	55,296	73.50	4,064,256	22.6
Rye	766	81.65	62,544	0.3
Oilseeds	(Bushels)	(Per Bushel)		
Flaxseed	150,116	7.17	1,076,346	[illegible]
Rapeseed	884,175	5.51	4,871,804	1.3
Sunflower	748,000 lb	.09 lb	67,320	N/A
Other oilseeds	437,815	5.51	2,412,361	N/A
Forages	(Tonnes)	(Per Tonne)		
Alfalfa Hay	712,595	51.25	36,520,494	10.6
Sweet Clover Hay	220	41.47	9,123	N/A
Grass Hay	12,086	38.00	459,268	N/A
Corn Silage	238,675	19.58	4,673,256	100.0
Greenfeed Silage	174,933	57.47	10,053,399	N/A
Tame Pasture	741,496 AUM	8.00 AUM	5,931,968	N/A
Specialty Crops	(Tonnes)	(Per Tonne)		
Peas	8,078	159.00	1,284,402	100.0
Canning Corn	152,119 lb	.04 lb	6,085	100.0
Potatoes	101,152	88.85	8,987,355	63.6
Sugar Beets	513,980	32.00	16,447,360	100.0
Dry Beans	8,071	159.00	1,283,289	N/A
Grain Corn	15,840 bu	2.70 bu	42,768	100.00
Carrots	3,879	59.00	228,861	80.0
Cabbage	734,139	.10 lb	73,414	N/A
Tomatoes	79,366	.48 lb	38,096	N/A
Miscellaneous Vegetables	15,647	38.10	596,151	N/A
TOTAL VALUE OF PRODUCTION			**149,459,830**	**8.29%**

Source.
Agriculture Statistics Yearbook, 1978, Statistics Branch, Alberta Department of Agriculture

Marv Anderson & Associates, *Oldman River Basin Study - Phase II. Economic Analysis of Water Supply Alternatives*, Willingdon, Alberta April, 1978

Contract Prices

Statistics Canada

quite profitable. It will be a long time before we export any corn because there are just not enough acres. But soft wheat and oilseeds we can export."

To develop these markets, and to produce crops to meet them, will take continuing investment in irrigation. Will the benefits go to "a small percentage of farmers and businessmen," or are they spread widely enough throughout the economy to warrant the costs?

In any reckoning of the benefits of irrigation, those that accrue to the primary producers, the farmers themselves, are counted only as part of the total. Usually considered much more significant are the indirect, secondary and even tertiary benefits either induced by irrigation (for instance, the labor, farm equipment and so on needed to do the job), or stemming from irrigation (such as the processing and marketing of some of the specialty crops). Benefits of investment in irrigation create a ripple effect through the entire economy, and that, say some economists, is why the investment is worth it.

But take a so-called benefit like the employment — in an irrigation equipment manufacturing factory, say, or a vegetable processing plant — made possible by investment in irrigation. If the people holding down those jobs would be unemployed otherwise, then it's fair to include that employment as a real benefit of irrigation. But what if, in the absence of irrigation, jobs were available for those people elsewhere? And who's to say that an investment in something other than irrigation might not yield even greater benefits?

Without irrigation farming, southern Alberta would be less prosperous — but it's hardly a depressed region. Marv Anderson and Associates Ltd., agro-economic consultants who made an economic analysis of water supply alternatives for the second phase of the Oldman studies, note in their report the considerable non-agricultural resources of the region — coal, petroleum, natural gas, gravel and bentonite — whose extraction "also represents considerable economic activity in the region."

The difficulty, says Dr. Travis Manning of the University of Alberta's rural economy department, is partly one of changing criteria when it comes to economic analysis. For instance, in order to gauge whether workers in jobs created by irrigation farming would be unemployed in its absence, some sort of standard for full employment in an economy is needed. Now, with changes in the work force caused partly by an increase of women workers, old standards no longer apply – and there are no new ones.

There are, in short, too many unknowns for confident economic prediction.

Hilton Pharis is a dryland rancher at Lundbreck, near Pincher Creek, and a member of the management committee. In the face of all the information supplied to the committee by consultants and others, he too is more concerned by the questions begged than by the questions answered.

"We demonstrated that irrigation expansion is financially acceptable," he says. "But I don't think it was broken down into how far you can go."

Pharis is also concerned that economic data don't give the total picture when decisions about water resources management are being made. Social and environmental information is crucially important too – but it can't be described in terms of numbers of acre/feet of water, or dollars and cents.

Many of those who express concern about continued development of irrigation are not irrigation opponents in principle. They concede that irrigation *is* worth a great deal of investment. No-one would wish the lush country around Lethbridge or Medicine Hat to revert to the barren treeless desert Captain Palliser found in the 1850s. Many of the real and potential benefits — in assured livestock feed, for instance, or future soft spring wheat production — seem hard to dispute.

But there does seem to be an increasing recognition that investment should have its limits; that the price of expansion may be too high; and that we need to answer some more questions before we commit ourselves to more ongoing and irrecoverable expenditure. This more cautious approach is having some useful spinoffs: as the stories on Pages 22, 24 and 27 show, there is growing concern now about water use efficiency and the energy costs of irrigation too.

The management committee's final report recommends three stages of integrated irrigation and water development, starting with a program of rehabilitation of existing works, and the development of more offstream storage. The report calls for a "multi-purpose flow regulation reservoir" on the Oldman River in the period from 1985 to 1990, to become fully operational between 1990 and 1995.

The ECA panel, whose recommendations followed those of the management committee, argues even more strongly for rehabilitation of existing works and offstream storage to meet future water needs. The report notes: "The Environment Council is convinced that an onstream dam is not required at this time, nor in the foreseeable future."

The ECA panel further recommends that irrigation farmers be required to pay a greater proportion — 25 per cent rather than 16 per cent — of the cost of the rehabilitation program.

In a minority statement in the management committee's report, Hilton Pharis writes: "The conclusions reached by the management committee that offstream storage should be implemented for the near future water needs is sound. The decision that onstream storage is necessary if the irrigation acreage in the Oldman River Basin is to be developed to its maximum is also sound. The question the Committee was unable to answer is: Do the people of Alberta think the price that must be paid for maximum development is justified?"

In the absence of an answer to that question, ECA panel chairman Platt feels the wise course is to proceed slowly. "There is so much to do in rehabilitation and offstream storage that it's going to take 10 years," he says.

By that time, we might have a better idea of what should be done next.

Gillian Sniatynski is the freelance editor of this magazine.

Andrew Vaughan

Say "irrigation farmer" and the image is often conjured up of the wealthy squire directing a push-button, fully automated operation with no risks attached. The reality may be somewhat different.

As a group, irrigation farmers are probably fairly well off. In discussing the farmers' share — a rather low 16 per cent — of the current rehabilitation program, ECA panel chairman Dr. Arnold Platt says: "I think that the modern irrigation farmer can pay more than perhaps at any time in the past.

"But one of the problems is that you still have a fair number of subsistence farmers on irrigated land, who don't have large enough operations, capital, or enough skills."

And what about the life of leisure irrigation farmers live?

Winters are not too bad. But summers are "a little hectic," says Rick Ross, manager of the Lethbridge Northern Irrigation District.

The irrigation farmer has all the concerns of the dryland farmer. But as well as that, he must change the location of his sprinklers every eight hours (and the changeover takes an hour.) He has to make constant adjustments in water supply and power supply to his pump. He has to change the oil in his pump every 24 hours, and the filters once a week.

Most irrigation farmers have cattle, which means more work too. And the specialized crops like vegetables need just the same sort of care a domestic vegetable garden does.

An easy life? From an irrigation farmer's point of view, says Ross, it's the *drylanders* who have it easy.

VIEWPOINT

Terrence S. Veeman

'The merits of expanded irrigation development in southern Alberta . . . are very dubious.'

The agricultural sector is by far the most important consumptive user of water in Alberta. Yet the economics of water for agriculture remain seriously misunderstood and under-researched. If we are not to waste public funds, we need better blueprints for the development and management of irrigated and dryland agriculture in the province.

The provincial government is committed to spend $200 million to expand and rehabilitate the existing irrigation system in southern Alberta. Recently, preliminary notions to utilize Alberta Heritage Savings Trust Fund monies for water diversion from northern to southern river basins have surfaced. In my view, the merits of expanded irrigation development in southern Alberta and particularly of water diversion for supplemental irrigation in east central Alberta are very dubious.

There are several forces which help to explain why new water development projects and irrigation expansion are currently popular in political and public circles in Alberta. The belief that irrigation would be a great boon to farmers and farm communities on the semi-arid prairies is longstanding and deepseated. Moreover, proposed schemes for irrigation expansion are clearly in the self-interest of individual farm families, even if such proposals may be questionable from the social point of view. Because agriculture is a renewable sector, there is a feeling, whether warranted or not, that investment in its basic infrastructure must be socially worthwhile for present and future generations. The dominance of engineers in Alberta Environment has led to a preference for structural solutions such as large-scale dams or diversion schemes to water management problems. Water resource projects are also politically visible and prone to what Charles Howe has termed "distributive politics" — the spreading of costs over taxpayers at large in Alberta and the concentration of benefits within a localized group of beneficiaries. Clearly, in Alberta, there has been an understandable political desire to distribute the fruits of the Trust Fund equitably to various regions in the province — originally to southern Alberta for irrigation to balance oil sands-related investments in northern Alberta and, in the last year, to neglected east central Alberta — but with insufficient attention to the relative merits of any individual scheme. Finally, there is the view, largely mistaken in my judgement, that new dams (such as the Red Deer and the proposed Oldman dam) and massive diversion schemes are needed for the industrial development of the province. Excepting hydro-electric projects, most future water resource development projects, if they are to be justified, must be justified primarily in terms of agricultural purposes.

However, irrigated agriculture on the prairies, given current and prospective crop mixes, is only a marginal economic activity in terms of social returns and costs. The root cause for this situation is that most irrigated area in southern Alberta is devoted to small grains, hay, and pasture, relatively low-valued crops on a per acre basis. Higher valued specialty crops (sugar beets, potatoes, and vegetables) comprise only 10 per cent of irrigated land and are likely to expand relatively slowly. At a public cost of $1,000 per irrigated acre, the proposed Oldman expansion is a rather costly means of increasing the effective supply of land in Alberta. It would be my conjecture that increased cereal and livestock output, the dominant products associated with irrigation, could be obtained more cheaply through investment in conventional dryland agriculture in the province.

The Oldman River basin planned projects are even more troublesome when evaluated in terms of equity considerations. Given the relatively low water rates assessed on irrigated acreage, irrigation farmers are highly unlikely to meet the operation and maintenance costs associated with these structures, let alone make any contribution toward the recovery of capital costs. One can't help but feel that the hue and cry for expanded irrigation would be dramatically curtailed if farmers were held responsible for the recovery of even 20 per cent of the capital costs involved in these public investments.

Fortunately, however, there now exists a better blueprint for water management in the Oldman River basin — the recently completed report by the Environment Council of Alberta. This document correctly lays stress on rehabilitation of the existing irrigation system as the top priority and recommends against on-stream storage (a dam) on the Oldman River. It is to be hoped that the provincial government will heed this advice.

It is now recognized that a master plan for irrigation in the South Saskatchewan basin (Oldman, Bow, and Red Deer Rivers) must be developed. It is imperative that this master plan be based on two previously neglected perspectives: the relative merits of investment in dryland versus irrigated agriculture (given that grains are the most obvious area for possible expansion in the 1980s) and the study of markets for irrigated specialty crop produce. My intuition is that through our current fixation with irrigation expansion and grandiose water diversion schemes, we are missing less obvious ways of genuinely assisting the existing agricultural base of the province. In addition to improving water efficiency and intensifying production on existing irrigated lands, we must seriously look for worthwhile investment opportunities in dryland agriculture, including improved water and snow management techniques.

Dr. Veeman is associate professor of economics and agricultural economics in the departments of economics and rural economy at the University of Alberta

Jack Spearman

Rights To A Resource

Water licensing helps ensure that demand doesn't exceed supply.

First come, first served has always been the policy in Alberta for getting a permit to draw water out of a river, stream or from the ground.

It worked well for decades after 1894, when the federal government issued the first water licence in the Alberta territory. In 1931, when the province assumed responsibility for water licensing, the population was small, irrigation farming was far less advanced than it is today, and first come first served still seemed feasible.

All of that has changed now. Demand for water — especially for irrigation purposes — has risen steadily in Alberta, where most of the water flows through the forested, less populated north and not through the dry farmland to the south. More formal means are needed now to decide what the remaining water will be used for.

"The trend to ever larger sprinkler systems of irrigation is just growing and growing," said Al Ferrett, head of Alberta Environment's surface water rights branch. "We used to get applications from farmers who wanted to irrigate a couple of hundred acres. Now, they do it a section at a time."

There are about 12,000 water licences in Alberta now; licensees range from small farmers to irrigation districts and large municipal and industrial users. Fees are paid on a sliding scale of consumption.

Irrigation is the largest single user. "One centre pivot in a sprinkler system can use as much water in a day as the town of Claresholm," said Dick Bennett, Lethbridge regional administrator with the department's water resources management division.

Water licensing to meet such heavy demands is no easy task in southern Alberta, where there are about 400,000 hectares of land dependent on irrigation for production, and where water is the rural economy's lifeblood.

If the streams and rivers of southern Alberta were to flow evenly and equally for 12 months of the year, there would be ample water to meet demands. But of course they don't — in many cases, much of the annual flow rushes through during spring run-off.

Grain growers start to irrigate a few weeks after the run-off, while a farmer with a field of alfalfa needs irrigation water into the middle of August for a second cut. But late in summer, flows have slowed almost to stagnation.

Methods of irrigation are also changing. Years ago, ditches were dug through fields to let water soak in, usually by gravity diversions during spring run-off. Now, large systems of expensive pumps and sprinklers which use water over a much longer season are common. And instead of being limited to low-lying land near water courses, farmers now pump water up out of the river valley and irrigate large areas on the plains.

In water licensing, explained Ferrett, a balance must be struck between supply and demand — a potentially tricky task when Mother Nature is involved. "The basic guideline we use is that if the person applying won't get sufficient water five years out of 10, we know our allocations are getting to be too much."

In a drought year, when farmers need water most, supplies are at a minimum. But when snowmelt and run-off are abundant, soil moisture is also generally adequate to grow a crop without irrigation. In other words, when the water's needed most, it isn't there, and when there's plenty, it isn't needed.

Take the case of Willow Creek, part of the Oldman River basin.

In an average year, about 91,000 acre/feet of water flow down it, although recorded flows have varied from 15,000 acre/feet up to 240,000 acre feet.

'It would be foolish to license it so that only a few people had water assured every year," said Bennett. "It would also be foolish to license it to the degree that nobody would get enough."

Three years ago, the province discovered that the demand on Willow Creek was more than the stream could handle during a drought.

A moratorium has been invoked on further licensing on Willow Creek and another basin stream, the Little Bow.

"I'm sure there's enough demand out there now on Willow Creek and the Little Bow that if in the middle of summer we were to let everybody pump off all they wanted, the streams would be sucked dry."

"Everything just came to a head that year," said Bennett. "There were complaints from senior licences (those with prior claims on the water) that they were getting neither the quantity nor the quality of water.

"In the past few years, we'd warned applicants of the potential for problems and that as junior (more recent) licensees they'd have to give priority to the senior holders," he added.

It's all made for some hard feelings among farmers along the creek. "When an applicant gets rejected, sometimes the initial reaction isn't so good," said Ferrett. "He's not exactly

Alberta Government Photo

thrilled to sit there and watch water flow past his fields to existing prior licensed users."

The province is now studying new management techniques for Willow Creek – one option of which includes establishing minimum flows for various portions of the stream.

Above Claresholm, said Bennett, the emphasis could go on fisheries protection and a flow of 100 cubic feet per second (2.8 cubic metres per second) is under discussion. Below Claresholm, where Willow Creek emerges from the foothills on to farmland, flows of 20 to 40 cfs (up to one cubic metre per second) are mentioned.

"But the conflict in what to do with minimum flows is a classic conflict," he added. Farmers see irrigation as the major function of the stream while fish and wildlife officials view the problem from their perspective.

Meanwhile, municipalities along Willow Creek talk about the need for a flow steady enough to dilute sewage discharge to acceptable levels and carry it downstream.

Other creeks in Alberta are also liable to suffer from over-licensing. Berry Creek near Hanna is under review while several streams in the southeastern corner of Alberta are also in trouble, said Bennett.

One approach to the problems of water licensing and over-licensing is storage and regulation of stream flows. That can include everything from farmers building off-stream storage ponds and damming off oxbows to irrigation districts or the government building major reservoirs.

Bennett and Ferrett both feel that storage, whether onstream (in dams) or offstream (in lakes such as Keho Lake) is the only practical way to increase the availability of water when it's most needed, by catching and storing large volumes of spring run-off.

In the Oldman River basin the province is studying three different onstream sites — at Monarch, Brocket and Three Rivers — for a dam on the Oldman River. Offstream storage sites are also being considered.

But as the experience with the Site 6 dam on the Red Deer River indicates, dams are not always seen as good management options. Decisions about building them can often be highly controversial.

Jack Spearman is a journalist in Calgary

Elaine Park

Perspectives On Irrigation

'Irrigation is an insurance to society . . .'
'Losing my land would shatter many a dream . . .'

Irrigation can turn dry prairie into rich, fertile fields. But the cost of building dams, water storage and transportation facilities makes irrigation a very expensive method of increasing food production.

To get different perspectives on irrigation, Environment Views talked to three southern Alberta farmers whose lives, in one way or another, have been touched by it.

Gary Park

Lud Prudek farms 160 hectares of irrigated land south of Bow Island in the St. Mary River Irrigation District. Normal rainfall in the vicinity is about 300 to 375 millimetres a year, but Prudek's irrigation permits him to raise crops such as sugar beets and dry edible beans whose moisture requirements are in the range of 500 millimetres a year.

His experience producing high-yield crops on what was recently dry, barren grassland has made him a firm believer in the value of irrigation. It benefits not only the individual farmer, but society as a whole, he argues.

"Irrigation is an insurance to society, a stabilizer," says Prudek. "It takes the risk out of relying on nature for good crops year to year, and guarantees our food production."

Most of Alberta's irrigation farming takes place in the south-east where irrigation districts were established early this century by railway companies hoping to entice settlers to the region. Today, the districts are farmer-owned co-operatives that deliver water between May and October to individual landowners who have installed their own distribution systems. Each farmer pays a yearly fee for delivery of the water—$8.20 an acre this year in Prudek's district.

Andrew Vaughan

Construction and improvements in each district's water transportation system are assisted by the provincial government which pays 86 per cent of costs. The government also helps irrigation by undertaking large projects like dam-building to create water storage.

"We must have both on-stream and off-stream water storage if we are to expand our food production on a limited land base," says Prudek.

A farmer considering installation of irrigation faces large initial costs.

"An investment of $300 an acre in irrigating equipment is not unusual around here," Prudek states. "Prices have been escalating, and delivery systems that cost $50,000 to $60,000 a quarter section five years ago now cost $75,000 or more."

The investment, however, immediately expands the number of crops the land can support and increases productivity.

"If you were dryland farming here, you would raise cereal crops or oil seeds. With irrigation, you can raise sugar beets, soft wheat, alfalfa, and specialty crops like dry edible beans. These crops open all sorts of doors, with spin-offs for the economy in processing industries, for instance.

"Also, the differential in productivity between irrigated land and dry land is about three to one. Irrigators do achieve fantastic yields if good husbandry is followed. For example, we can reach 100 bushels of soft wheat per acre."

Although Prudek staunchly supports irrigation as a concept, he sees much that is wrong with the way it is practised in North America.

"The resources of land and water are the most basic resources we have. Water is more important than oil, and we must learn to manage and conserve it better," he says.

He points to monumental follies south of the border where irrigation in some areas has lowered the ground water table beneath the level required to run the systems, and where large irrigation projects may soon have to be abandoned because of the prohibitive cost of the energy required to run them.

Alberta, too, may be heading for an irrigation crisis, he warns.

"Our transportation systems are out of date. They must be made more efficient. Now, our midday flow is much less than it is at night because of evaporation from the open delivery channels. And if you fly over this country, you can see the damage done by seepage from the canals. We can eliminate most of the loss to seepage and evaporation — which is about 15 to 20 per cent — by enclosing the water and burying the pipe. Here, where the elements are severe, such a system would mean the cheapest food production in the long run."

In the short run, the cost of revamping the transportation systems will be much greater than the district co-operatives can bear on their own. Prudek makes a case for government funding of the capital improvements.

"Society can't afford to lose any more of the land base or reduce food production," he says. "As a farmer, I have a responsibility to society to produce food as cheaply as I can. By the same token, society has a responsibility to enable me to do this. People in Edmonton and Calgary have to realize they're going to benefit if we improve our irrigation transportation."

While Prudek sees "a crunch coming in these districts in the next five years" if delivery systems cannot be made to conserve more water and use less energy, he is optimistic that the necessary changes will happen.

"We have the research capability, but we have to develop new attitudes and then start doing what needs doing together," he says. "Let's not be a bunch of hyenas each yapping for his own big piece."

As an individual, Prudek practises what he preaches. His irrigation system is designed to use practically no fossil fuel.

To minimize evaporation, the water is carried in 8,800 metres of pipes, of which 5,150 metres are buried polyethylene pipes with an indefinite lifespan. Gates in surface pipes let water flow into channels in the fields, and a slight grade ensures that the water runs across the whole crop.

Evaporation is much less than it would be with a sprinkler system, and the force of gravity, not the push of a gasoline-powered pump, is the energy employed.

"The energy crunch won't affect this farm much," says Prudek proudly.

John Zoeteman farms 704 hectares of land near Fort Macleod, about eight kilometres from the boundary of the nearest irrigation district. His parents settled in the area in 1910, and Zoeteman has spent his life farming on the family land and raising his own two sons.

Until 1972, he was a dryland farmer raising cattle and cereal crops, but that year his thinking changed.

"1972 was a very dry year," he recalls. "I had 30 head of cattle on pasture next to the Oldman River. In five weeks, there was no grass left. I figured there had to be a better way to use the land, and I applied for a licence to take water from the river."

The licence came through in 1975, and Zoeteman tried his hand at irrigation farming. He installed a side-roll sprinkler system on 44 hectares of land adjacent to the river.

"It was a prairie grassland that had never been broken," he says. "1975 was the first year it was cultivated. Last year, we harvested 75 bushels of barley and 64 of durham wheat.

"I'm very glad I irrigated. We are assured of a crop, now. We know we'll have feed for the cattle and bedding for the cows because we bale the straw on it."

Living outside the irrigation district, Zoeteman must shoulder the capital costs of both transportation and distribution of water. No government funding assists him, although the federal government helped with a land survey when he was planning the project, and Alberta Agriculture advised him about calling for tenders on the major welding. Zoeteman says that advice saved him about $5,000.

Doing much of the installation themselves, Zoeteman and his son were able to put in the 1.6-kilometre-long side line with two half-kilometre-long side rolls for about $30,000.

Zoeteman does not regret missing out on the help the irrigation district would have provided.

"In the district, they have to pay for use of the water. My expense is in setting up my own system, but I don't have to pay for water," he says.

Maintenance costs are also significant. The water must be pumped up an escarpment 54 metres high before it can flow to the irrigated acreage, and the pump, which is fuelled by natural gas, costs $1.10 an hour to run. Pumping 800 gallons a minute, it never shuts down between spring start-up (usually mid-May) and a September shut-down.

Large as his investment is, it is already turning a profit, says Zoeteman.

"I grew malting barley on the irrigated land last year, and was lucky enough to ship a carload off it. The durham wheat was all number two."

Considering the land was rough prairie only five years ago, Zoeteman has been agreeably surprised by its productivity under irrigation, and by its tendency to improve every year.

In his dryland, Zoeteman cultivates half the acreage each year and leaves the other half in summer fallow to conserve the soil moisture. Rainfall is an average 250 to 300

millimetres per year, though it takes 375 to 450 millimetres to achieve an optimum crop yield.

"The big advantage to me is that irrigation allows continuous cropping," says Zoeteman. "Irrigating a quarter-section is like buying another half-section of dryland."

Wishing to provide his son with land to start farming on his own, Zoeteman had been thinking of purchasing more. Since the success of his irrigation experiment, he has changed his mind.

"With the price of land what it is, it's difficult to buy for a young fellow. Rather than buy more land, we intend to make what we have produce more. I hope to put in a pivot irrigation system and irrigate a whole other quarter section as soon as a licence comes through."

The pivot system will cost about $80,000, but it is estimated to pay for itself in eight years.

The possibilities of irrigating are limited, however. Only land near the river is suitable for Zoeteman because his transportation costs over a distance would make the project uneconomic.

On the vexed question of dam construction, Zoeteman can see both the objections to flooding more land, and the benefits that could flow to farms downstream. He has no strong feelings one way or the other on a proposal to build a dam complex in the Oldman basin.

"Without irrigation, I'm still only six inches (150 millimetres) short of excellent rainfall for crops here. If the dams are built, I wouldn't have to worry about fluctuations in the river level. And I wouldn't be told to shut down my system, as I am now in a dry year."

Peter Maloff farms at Cowley, west of Fort Macleod, on land he was born on in 1924. Aside from an irrigated vegetable garden, he uses dryland techniques exclusively.

Maloff is unconvinced by the arguments of irrigationists that society as a whole needs expanded irrigation systems. Building up those systems downstream may cost Maloff some of his best land.

Gary Park

In 1976, government proposals to build a complex of storage reservoirs in the Oldman River basin met with fierce opposition from landholders in Maloff's neighborhood, where 22 farmers were facing loss of prime riverside acreage if the plans went through.

Compensation offered was $200 an acre and 40 per cent of the costs of relocating any buildings in the flood path. No final decision about the proposals has yet been announced.

The buildings threatened on Maloff's land include an ancient barn built by his pioneering father, which Maloff has taken pains to preserve and restore, as well as two farmhouses. Trying to "relocate" these structures, which lie in a valley at the foot of a steep riverbank, is futile, he says.

"I would lose 200 acres (80 hectares) of my best land to the dam. It's where I raise most of my hay, and where we plant our gardens. I would have to sell some of my cows. Replacement land is hard to acquire these days, and I'm too old to be starting over.

"I remember my Dad saying this land was the most beautiful he had ever seen. Why should it disappear, and the government spend millions of dollars, for the sake of a few hundred farmers downstream?

"If those irrigation farmers used better management, fixed their canals, and used more offstream storage, I'm sure they could continue to raise fine crops."

The storage area created by the dam would flood 4,000 hectares of producing land, says Maloff. It would also destroy a beautiful river valley. He questions the value of destroying his family's heritage, prime recreation areas, and proven productive land, in order to improve the lot of other families with an expensive irrigation development that rising energy costs may make obsolete by the end of the century.

"Losing my land would shatter many a dream," he says. "My boys were going to live on that land."

Maloff owns three sections near Brocket, below the proposed dam site, and he could benefit substantially on that land if the project is approved. But he is still adamant in his opposition. The beauty of the river valleys is more important to him, and to all Albertans, he says.

In order to control water levels downstream for irrigation, the storage area above the dam would have variations in water level that could leave the banks bare for part of the year. Where now there are trees and wildlife, there would be a sterile slope that, Maloff speculates, could only encourage erosion.

Rainfall in the Cowley area is about 375 to 400 millimetres per year, although much drier years do occur. Maloff follows good dryland procedures on his five sections, conserving moisture by "keeping a lot of trash on top of the soil" and by using summer fallow.

He uses half the land for pasture for a herd of 80 to 90 cows, and the rest he cultivates for cereal crops.

"With good farming practice, I have had barley and oats up to 90 bushels per acre," he says.

Even in drought years, the natural methods of conserving moisture can keep the soil productive without resort to irrigation, Maloff contends.

"1977 was the worst year around here that I can remember," he says. "But even in that year, where we had had summer fallow, we still cropped 20 bushels to the acre. On stubble, it was a complete wipeout."

Elaine Park is a freelance writer living in Calgary

Speaking Up

Public hearings on water management in the Oldman River basin gave people a chance to take a stand.

The Oldman River rises from a lake on Mt. Lyall in the Rocky Mountains. From there, it flows eastward through Alberta's foothills and plains as a principal tributary of the South Saskatchewan River

The Oldman and its tributaries are the major sources of water for the 125,000 people who live in the Alberta portion of its basin. Their demands — for municipal, industrial and recreational water, and for supplies for irrigation — are growing. And they're demands which can no longer be met by an unregulated, "natural" river subject to wide seasonal variations in flow.

The provincial government, recognizing the need for adequate water supplies to develop Alberta's resources, has placed a high priority on the use of water for irrigation in the Oldman River basin. Six years of government-funded study into the problems of water management in the basin have culminated in several options now before the cabinet for expanding irrigated acreage.

The process by which these options were developed, discussed in a public forum, modified and presented gives just one more example of the old truism that you can't please all of the people all of the time. As in any case of decision-making for the "public good," trade-offs have to be made and the question asked, "Good for whom?"

The first phase of the Oldman River basin management study began in June, 1974 and was completed two years later. Various recommendations (among them, a dam on the river at the Three Rivers site north of Pincher Creek) were made, and the public was invited to respond.

The second phase of the study took some of its direction from the 80 or so briefs submitted from the public, and also considered some other water supply alternatives. The Oldman River Study Management Committee, which directed the second phase of research, was composed mainly of concerned private citizens and experts in

various areas of water use and management. The committee also considered reports on water use and supply alternatives, water quality, economics, social and environmental factors and watershed management among other topics — from 16 consultants.

While the studies were proceeding, the river had not been quiescent.

In the summer of 1977, streamflows in the Oldman were so low that the Lethbridge Northern Irrigation District had to cut off its water for 10 days at the peak of the irrigation season. Some farmers didn't suffer from the cut-off; others, growing crops such as peas and potatoes which had to have water during the cut-off time, did incur economic losses.

Then there were the periodic floods. During June, 1975, floods in the basin caused damage of nearly $2.5 million.

Streambank erosion was another, perennial problem.

Against this background, the management committee submitted its final report and recommendations in August, 1978. Briefly, it proposed integrated irrigation and water development in three stages. From 1979-1985, the increase in acreage should be limited to about 20,000 hectares, to be achieved by main canal rehabilitation and enlargements, and development of offstream storage at Keho Lake Reservoir, Mud Lake Reservoir, Sauder Reservoir and Forty Mile Coulee Reservoir.

From 1985 to 1990, about 40,000 new hectares should be brought under irrigation by means of further main canal enlargement and rehabilitation, and the construction of an onstream reservoir on the Oldman River. Of three possible sites, the committee rejected the Fort Macleod site but left open the choice between Three Rivers and Brocket.

From 1990 to 2005, the committee recommended that a further 40,000 hectares should be brought under irrigation (making a total of some 340,000 hectares in the basin) by means of enlargement of Chin Coulee Reservoir and the possibility of pumping facilities on the Oldman near Chin.

The next step was to air the recommendations. The Environment Council of Alberta (ECA) conducted public hearings in several centres in the basin in November, 1978, and received 205 briefs.

According to Dr. Arnold Platt, the chairman of the ECA panel, most of the briefs were presented from the standpoint of self-interest, and "that's what you would expect."

The "self-interests" represented included irrigation farmers and irrigation district officials, representatives from Indian bands, commodity groups, municipal government, nature and other conservation groups, academics, those whose land would be flooded, and more.

Few had any arguments with proposals to rehabilitate existing irrigation systems in order to make them more efficient. Offstream storage options were more controversial, as farmers concerned about displacement of farmland, or drainage problems near the reservoir, aired their fears.

But the hottest potato concerned the possibility of a major dam and onstream reservoir on the Oldman. For some, dams conjure images of bulldozers advancing menacingly on the lone farmer defending his beleaguered farmstead; for others, dams

mean assured progress and a future free of water shortages.

Both sides of the argument were well represented at the hearings.

At Taber, irrigation farmer Michael Truyaert spoke up for onstream storage, with a dam or series of dams "built someplace up in the mountain in the source of these waters to dam them, and to provide us with a reservoir for flood control (and) flow regulation in the Oldman River."

At Picture Butte, the five children of Audrey and Bob Westrop spoke eloquently about the lifestyle they enjoyed on their cattle ranch by the Crowsnest River — raising calves for 4H, going trout-fishing, swimming in the river — before their parents made their presentation. A dam at the Three Rivers site would displace the Westrops and many other farmers.

"How do you attach a dollar value to a third or fourth generation farmstead?" asks Carl Primus, head of Alberta Environment's planning division.

The current government policy is to send in two independent assessors to evaluate the fair market value of land intended for displacement. Other alternatives being considered are replacing land with land, or providing grants for retraining of displaced farmers. None of which, perhaps, can ever compensate for the loss of home.

Native rights and land claims is another sensitive issue in the working out of a water management policy for the Oldman basin. One of the onstream storage site options, at Brocket, is on the Peigan reserve.

"Because the Brocket site is on Indian-owned land, it's not appropriate for the government to initiate negotiations," says Carl Primus. The Peigans have asked for five years' lead time to study the benefits the band might obtain from the sale or lease of the Brocket site.

Meanwhile, at the Lethbridge hearings, a brief from the Blood Indian band spoke of critical unemployment on the reserve and the great benefits which would accrue from an irrigation project there.

Also at the Lethbridge hearings, Gene Scully of the Lethbridge Fish and Game Association spoke of fishermen's concerns about an onstream reservoir.

"Irrigation impoundments on the rivers are used exclusively for the diversion of water and minimum flows below these structures have not been adequate for proper fish management . . .

"Fishermen are not against a dam on the Oldman River if it is proved to be necessary, but we cannot keep taking from the pot without putting something back. Just because it is virtually impossible to put a dollar value on sport fishing does not mean that its value to the citizens of this area is not worthy of consideration."

The ECA panel made its report and recommendations in August, 1979. It supported the management committee's proposals concerning rehabilitation of existing systems, and the development of more off-stream storage at Keho Lake, Mud Lake and Forty Mile Coulee.

Much beyond that, however, the ECA was not prepared to go; notably, an onstream storage reservoir is considered unnecessary until some considerable time into the future.

Susan Mayse

The Cost To The Environment

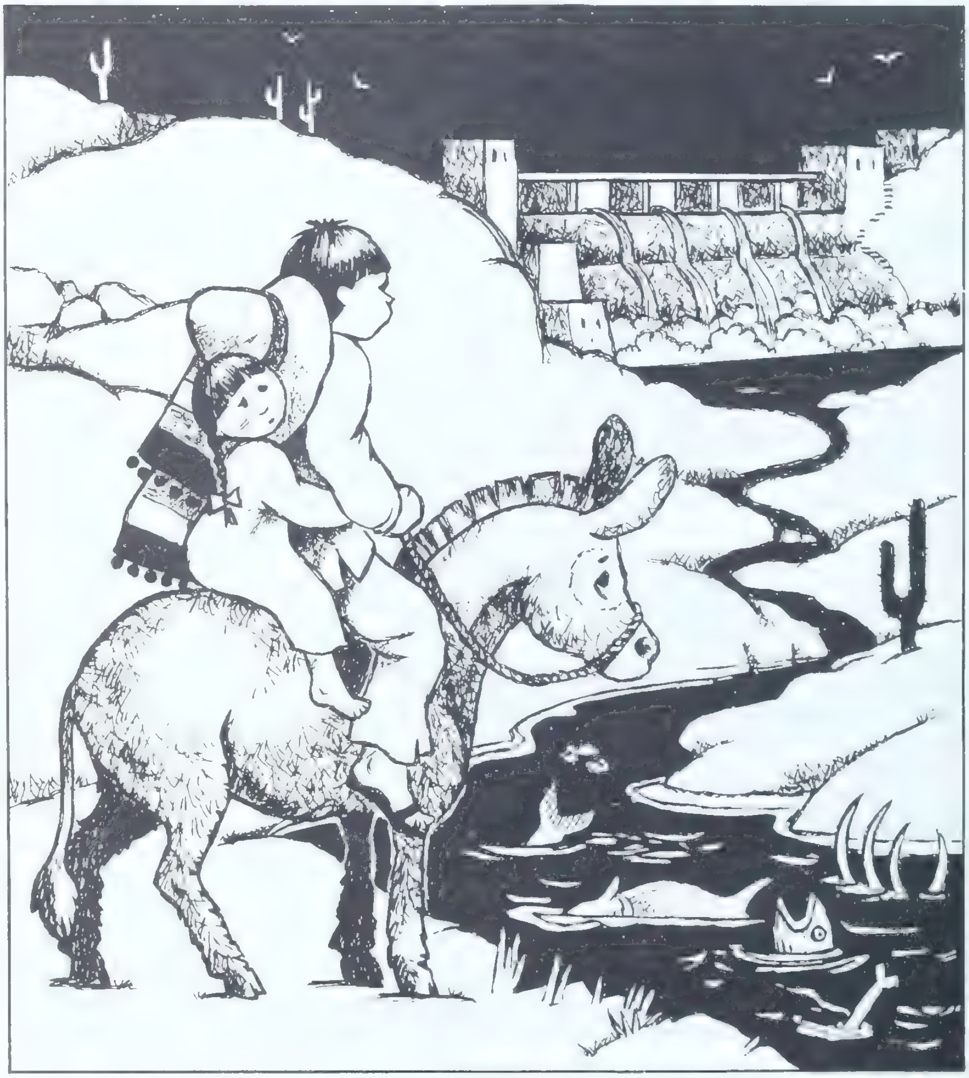
Irrigation has some undesirable side-effects.

Seven cities of gold lie beyond the desert, and their emperor sleeps under a tree hung with golden bells; so ran the story. Spanish conquistadores believed it enough to trudge miles across scorched barren country seeking the treasures of Eldorado, and found only the sun-gilded adobe houses of Indian pueblo towns. Nevertheless, in 1540 they were the first Europeans to explore the great Colorado River.

If the cities of gold never materialized, wealth of a different kind became a reality four centuries later, when farmers harvested their first crops on lands irrigated by water from the Colorado. Desert areas of southern California offered sunshine and soils suitable for year-round agriculture — with sufficient water in storage to prevent seasonal fluctuations which could capriciously starve or flood a crop. In 1901 entrepreneurs diverted major flows of water into California's Imperial Valley to irrigate farmland.

Cotton, melons, lettuce, alfalfa blossomed almost overnight on the desert. It was a vision of bounty, a dream sprung to life until 1905 when spring floods suddenly transformed the agricultural land of the Imperial Valley into a shallow 38,850-hectare sea. Two years and $3 million later the devastation was repaired, but an uneasy truth became apparent: diverting water to create a garden in a desert has no assurance of permanent success. In other instances, less severe, levees were continually being breached. The need for flood control was all too apparent.

If the deserts were to continue to bloom, however, storage was also needed in the lower basin to supplement low season stream flows. Pressures from this area began to grow in the years before 1922 — and so did interstate rivalries. Population was increasing more rapidly in the lower basin, and it was becoming apparent that the normal flows of the Colorado would not be adequate to supply all the uses envisioned by the basin states. But the states of the upper basin saw as a threat to their future water resource the proposals for storage in the lower basin.



The solution, reached in 1922, was the Colorado River Compact, an agreement which divided the water fairly between the upper and lower basin states but left each state free to use its own water allocation as it chose. But the rights of Mexico, as the ultimate recipient of Colorado flows, got only passing notice. It wasn't until 1944 that a treaty between the United States and Mexico provided an allotment to Mexico of 1.5 million acre-feet annually.

Compacts and treaties signed, Colorado water users proceeded to make the most of the river's bounty. A series of immense dams — from the Fontanelle in Wyoming down to the Morelos in Mexico — was built to store water. Even the famous Grand Canyon was threatened by damsite proposals. (Controversy is raging today over the flooding, further upstream, of the Glen Canyon which houses the spectacular Rainbow Bridge national monument.)

The hazards of all this development emerged more slowly. With approximately four-fifths of its flow diverted before the Colorado reaches the Mexican border, the remnant that trickled on into Mexico was extremely saline, and little use for the Mexican cotton crops downstream.

Reduced excess flows from the upper basin to dilute the salt load were partly responsible. But another major cause of the river's salinity was the extensive practice of draining irrigated agricultural land. The drainage was necessary to lower the water table and leach the salts out of the soil: but returning the drained water, containing high salt concentrations, to the river was only saving the land resource at the expense of the water.

In 1961, salt concentrations in the water were so high that the government of Mexico formally complained to the United States that "the delivery of water that is harmful for the purposes stated in the (1944) treaty constitutes a violation of the treaty . . ."

A 1977 report of the U.S. Environmental Protection Agency notes that "the salt load of the Colorado River is a major national problem. Unless corrective actions are taken, the present average salt concentration of about 850 milligrams/litre in the lower reaches of the river may increase to about 1,200 mg/litre by the year 2000. Such an increase would have serious economic consequences for the seven states adjoining the river and for the Republic of Mexico."

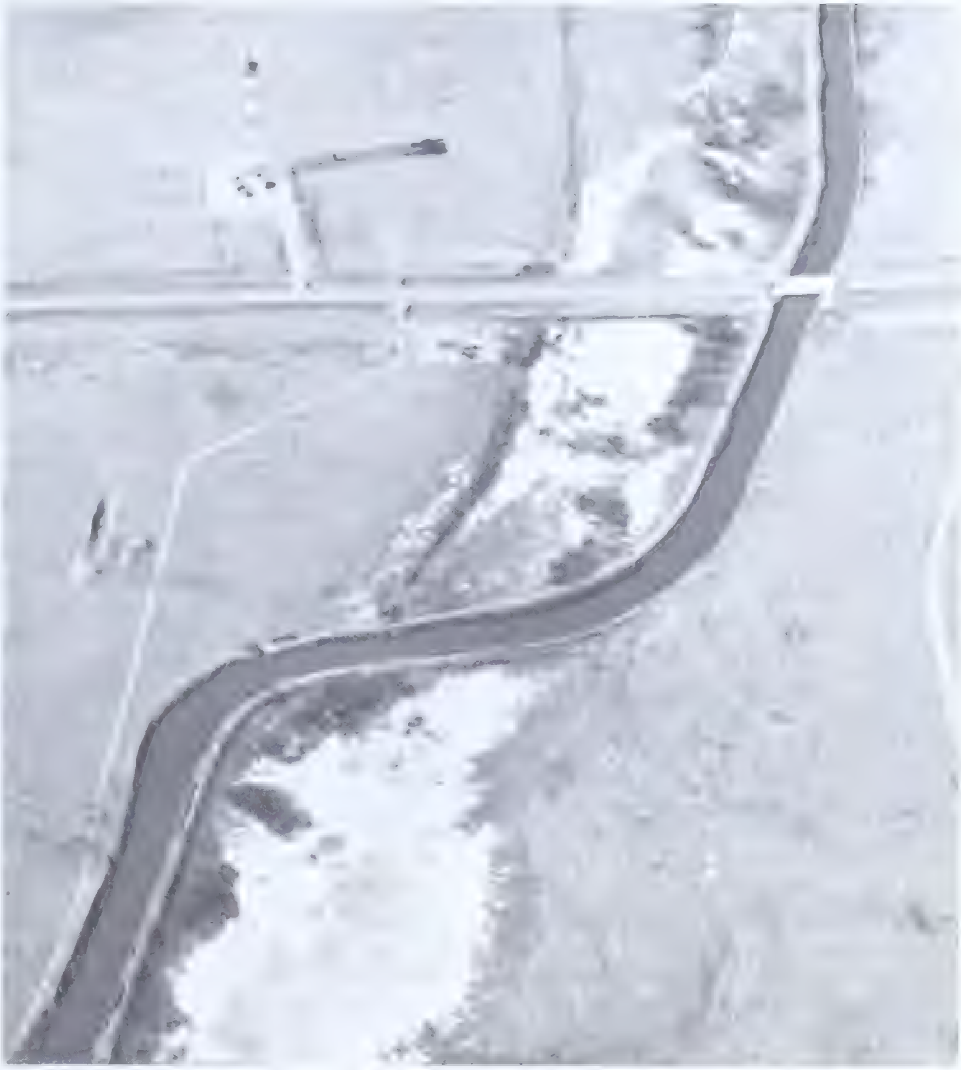
So measures are in hand to try to remedy the problem. Bypass drains, a major desalting unit at Yuma, irrigation efficiency improvements and irrigable acreage reduction are planned or already in effect.

Meanwhile the mighty Colorado struggles on, dwindling to a salty shadow of its former splendor.

Alberta also began irrigation at the turn of the century, drawing water from the St. Mary River to irrigate about 1,400 hectares near Lethbridge and Magrath. Today about 320,000 hectares in the southern part of the province draw irrigation water from the Bow, South Saskatchewan, St. Mary and Oldman Rivers.

Irrigation is big business in Alberta – not only to farmers but to engineers, land-moving contractors, and equipment suppliers. Wheat, alfalfa, pasture, and vegetable crops all depend on applied water.

Seepage-related salinization along an irrigation canal.

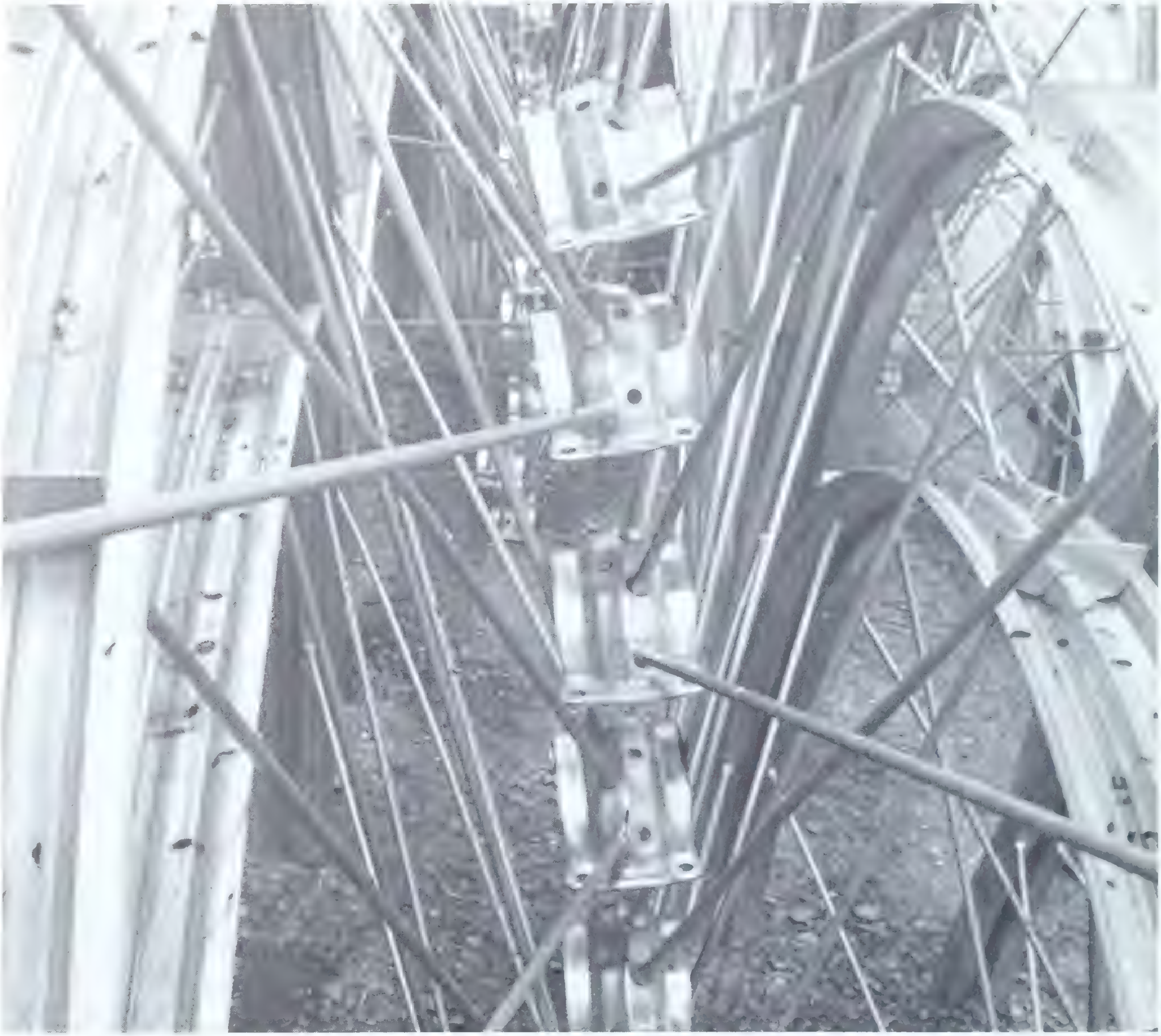


Demand for more water, and the storage facilities to hold it, is constant. Now conservationists and resource experts cast an eye at the example of the Colorado and other American river systems, and question the wisdom of increasing present irrigation levels.

It all starts with water, and soil.

"Water dissolves minerals — that's why the sea is salty," says Dr. C.F. Bentley, former professor of the University of Alberta soil sciences department, now a consultant. "This goes on everywhere you have rainfall. The amount of salts you will get in a particular area depends on rainfall, on biological conditions, on growth, on whether you have a 'refrigerator' operating several months of the years as we have in Alberta. Most important, it depends on the composition of rocks and soils."

Irrigation water, like any other naturally-occurring water, contains salts. Commonest salts in western Canada are sodium sulphate, calcium sulphate, and magnesium sulphate — and each reacts differently in different soil and growth conditions. Although the proportion of salt to water may be extremely



low — perhaps 500 parts per million evaporation eventually causes salts to accumulate in the soil. They also leach from water passing through irrigation canals, and seep into surrounding soils. The degree of seepage, says Bentley, varies vastly from condition to condition.

"If irrigation is being done, it's possible more water is being put on than the crop can take up. Water may accumulate at that spot, and raise the water table. Or, if there's an opportunity for seepage, subsurface drainage may take it away somewhere else."

The usual result in either case is a rise in the natural water table — another complex factor, since the original water table could be anywhere from a few centimetres to many metres below the surface.

With natural salts present in the soil, and more applied through irrigation which tends to raise the water table, the cumulative effect is of water much saltier than previously, closer to the surface. Few crops are resistant to salts, and the result can be impairment or total nonproductivity of farmland. In areas of India and Pakistan irrigated for the past 100 years, the effect has been grave enough to bring the water right to the soil surface and prevent any agriculture in some places.

"It's now generally accepted that it's extremely unwise to put in an irrigation system without at the same time at least providing for a drainage system — this will possibly drain off water so the water level never creates a problem."

Solonetzic soils are a variation of the salinity-groundwater problem. They have adverse physical properties because of the nature of the salts that have been in them. Dry, they harden and crack. Wet, they swell severely enough to crush plant roots wafer-thin. Like other soils, their ill effects can be aggravated by the application of irrigation water.

About 4.9 million hectares of arable Alberta farmland, in an 80-kilometre-wide belt stretching from east of Edmonton south to Brooks, and in the Peace River country, are affected — and there's no easy solution to the problem.

Irrigation is relatively recent in the province, and water tables may not stabilize for another 30 to 40 years, says Hank Vander Pluym, a dryland soil specialist with Alberta Agriculture in Lethbridge.

"Fluctuations only started to show up about 30 years ago, and right now we're at the peak of the increase."

Vander Pluym estimates that about 25 per cent of Alberta's irrigated farmland is affected by salinity, but considers that eventually 80,000 hectares of farmland could be totally or partially out of production in

Alberta as a result of salinity.

A recent Montana study indicated that eventually 40 per cent of all irrigated farmland in six states and provinces (Alberta, Saskatchewan, Manitoba, Montana, North and South Dakota) could be severely or lightly affected. At present 80,000 hectares of this prairie region are completely non-productive, much of the area actually coated with surface salts.

"When you fly from Calgary to Lethbridge and look down, you'll see salt sloughs and pure white fields — these may have a centimetre-thick crust of salt. By that point, a field has gone beyond reclamation."

Reclamation of saline land is "our aim in life," says Brent Paterson, head of the drainage section of Alberta Agriculture's irrigation division.

Salinity in Alberta is a problem, he feels, that's "certainly not decreasing."

It's a problem, too, that he thinks shouldn't be blamed solely on irrigation.

"Generally on most of the drainage investigations we have done only about one out of 50 or 100 is the direct result of the farmer putting water on the land and elevating the water table . . .

"In most cases water has come from an outside source — seepage, or natural groundwater flow."

Ray Schuler of Alberta Agriculture's irrigation division feels that salinization is probably more of a problem in dryland areas, and notes that sometimes salinity moves from dryland into irrigated areas.

Seepage from canals is, however, recognized as a major cause of salt increase in southern Alberta soils. Paterson is hopeful that current programs to rehabilitate distribution systems will show up in reductions in salinized area. Alberta Environment's headworks program is a first step in the process.

"What we're doing is monitoring seepages along the canals and recommending repairs where water is seeping out of canals," says Howard Christie of the department's Lethbridge office.

Groundwater and soil tests are the usual means of testing seepage and salinity, carried out once a month during a three- or five-year test program. "We like to see a year's results before we make a proposal to reconstruct a whole system or part of it."

Corrective measures may consist in adding "interceptor" or "relief" drainage near the faulty canal, he explains. Interceptor drainage often runs as a single line parallel to a ditch. Recovered water feeds into a sump for return to the canal to avoid affecting downslope lands, or preferably into a natural outlet such as a river or lake. Relief drainage is placed instead in several parallel lines under a field affected by seepage.

Prohibitive costs probably prevented rehabilitative work from starting sooner, Paterson feels. Lining of canals, for example, costs from $62,000 to $94,000 a linear kilometre — and there are 9,600 kilometres of canal.

In spite of the $1,000-per-hectare costs of draining farmland, more and more farmers are expressing interest, Paterson says. "Controlling that water table through drainage in conjunction with (the farmer) applying irrigation water will leach the salts."

Other reclamation of salty soil is possible by using chemical weed treatment in place of summer fallow in years with adequate moisture, or planting deep-rooted crops such as alfalfa which move the salts down through the soil profile.

Advising farmers directly, and showing them results through test plots, are Alberta Agriculture's methods of getting the message across.

Department officials' cautious optimism about control of salinity problems in the province is not, however, universally shared.

"There is a long-standing proposal to have a large irrigation project in the Youngstown region, where the soils are predominantly solonetzic," says Bentley.

"Engineers who seem to be unaware of the soil conditions are eager to go ahead."

When Stanley SLN Consulting of Edmonton completed a study on irrigation in the Oldman River basin in 1978, soil salinity and water levels were a prime concern.

"The salinity problem is in our view serious, more severe than is generally recognized," states the summary report.

"Serious (visible) salinization is common along canals where seepage losses are high and in depressional areas, but there is much more extensive moderate (invisible) salinization within all the Irrigation Districts.

"Provision of subsurface drains is the only method available for most irrigated areas of the Oldman Basin which will allow sufficient water flow through the soil profile to maintain a favorable root-zone salinity level."

The report advises widespread study to enhance the effectiveness of present irrgation, and application of irrigation funds to existing projects rather than irrigation expansion.

If drainage is seen as a major solution to problems of land salinization in the province, there will be a price to pay.

Dave Graveland, head of the technical development branch of Alberta Environment's earth sciences division, points out that water retrieved by drainage contains high concentrations of salt. At present, there seems to be no other alternative but to return that water to the river — with highly detrimental effects on water quality, as the Mexico users of the Colorado River have already discovered.

Susan Mayse is a freelance writer living in Edmonton

Less Waste Means More Water

Efficiency in water use is the name of today's game.

Alberta Government Photo

Andrew Vaughan

In the otherwise parched farmlands of southern Alberta, irrigation water is liquid gold. It means assured production yields of a diversity of crops.

Assured, that is, as long as the water supplies hold out.

A sharp reminder that supplies are not limitless came in the summer of 1977, when, as a result of low streamflow in the Oldman River, the Lethbridge Northern Irrigation District was required to restrict water use at the peak of the irrigation season.

Problems of seasonal variation in flows of the rivers in the Oldman River basin, and the need for additional storage to capture water for use when it's needed, have resulted in six years of study into water management problems in the basin. They've also sparked an awareness — among irrigation farmers, irrigation district officers, government officials and others — that, in the absence of other solutions, it makes very good sense to use wisely the water that *is* available.

Water conservation is possible in two important areas of an irrigation system: in the network of canals and ditches which deliver the water to the farmer; and in its application on the farm.

In the distribution systems, the potential for water savings is tremendous.

Irrigation structures have a limited lifespan, and by the late 1960s many were badly deteriorated. J.W. Thiessen, director of Alberta Environment's design and construction division, and R.F. Smith, manager of Alberta's Agriculture's irrigation secretariat, in a recent paper on modernizing irrigation systems in Alberta, note that some canal stretches were deeply eroded.

"Other reaches had siltation, or weed and tree growth which restricted the flow carrying capacity. It was estimated that up to 10 per cent of the total irrigated area was affected by seepage from canals. Wooden drop and check structures were badly deteriorated and there were frequent periods of interrupted water delivery due to failure of some portion of the water distribution system."

Another problem concerned layout of irrigation systems. The early canals were laid out on the contour of the land, while land ownership boundaries in western Canada follow the grid system. This created many irregular-shaped parcels of land which didn't lend themselves to modern irrigation methods.

A comprehensive study to determine the extent of the rehabilitation needed provided the basis for a cost-sharing program under which water users pay 14 per cent of the capital costs of projects to upgrade district works. This program has expanded from an annual government share of $1 million in 1969 to $11 million annually for a 10-year period starting in 1976.

Part of the rehabilitation has involved relocation of canals to run parallel to or adjoin legal boundaries. Improved layouts can also provide for the re-use of return flows from adjoining irrigated areas.

The inclusion of strategically placed reservoirs within the distribution system can also improve efficiency, say Thiessen and Smith. They act as balancing pools in periods of fluctuating demand, and also serve to catch local run-off and store it for later use.

Lining of distribution canals, and the use of buried pipe to carry water, both help reduce water losses due to seepage or evaporation. For example, in a rehabilitation project in the Burdett area between 1977 and 1979, about one-third of the distribution laterals were placed in buried pipe and the rest were lined with concrete. Depending on soil type and canal size, linings such as polyethylene membranes, clay and folded fibreglass have also been used.

Past the farm gate, the potential for water savings is also great. In some cases, much more water is applied than is actually needed for crop production. Some water, once applied, evaporates, some percolates beyond the rooting zone, some goes as surface runoff. New technology is helping to reduce these problems too.

Sprinkler systems, for instance, give the farmer much better control of the amount

Irrigation siphon, Lethbridge area

Alberta Government Photo

of water he's using, and also tend to reduce the amount of runoff. A recent design of the centre pivot sprinkler system directs the spray of water downwards at fairly low pressures. This system reduces evaporation losses (and has lower energy requirements) than the high-pressure, large-nozzle units. *(For more information on new irrigation equipment, see the story on Page 24.)*

The farmer needs more than good equipment, however, to make best use of the water available to him. Good management is important too.

Alberta Agriculture offers two irrigation management services to farmers through its irrigation division at Lethbridge. The first concerns extension and technical services: irrigation specialists are available to counsel farmers on water use in any aspect of irrigation; and engineering technicians work on surveying and designing water distribution systems on farms and answer any technical questions the farmer may have.

The main aim of this program, says Gerhardt Hartman, head of the irrigation division's irrigation farm development section, is to eliminate runoff or waste water on the farm.

The second service is the summer-long irrigation scheduling program.

The effectiveness of irrigation scheduling is based on the fact that different soil types have different holding capacities for water, and that different crops have different water needs at different times.

For example, sandy loam soils will generally store about 100 millimetres of water per metre of root zone. Good irrigation practice, says Alberta Agriculture, would be to replace the top 50 millimetres whenever it is used up. On the other hand, loam and clay soils have a greater storage capacity; replacement of the top 100 (or 120) millimetres of water would be necessary.

Cereals require most of their water during the root and grain-forming stages. Alberta Agriculture officials say that in southern Alberta, irrigation of grains could end after about July 20 without significant yield loss. Alfalfa, however, grows vigorously through the whole summer if it's cut and watered regularly.

Plants also differ in their ability to respond to irrigation after drought. Grain will suffer and not come back to full production after a very dry period. Grasses, however, will usually came back to full growth rates after proper irrigation.

Irrigation scheduling involves taking into account every aspect of the delicate plant-water-soil relationship, as well as details of weather conditions and the sun's radiation, to assess current and predict future crop water needs.

"We advise about when and how much to irrigate so that water is put on when the crop needs it — not before and not too late," says Hartman.

"In Alberta traditionally farmers tend to irrigate too late for crop production." And water that fails to do the job is, in effect, water wasted.

The objective of irrigation is, after all, to achieve optimum crop yields. So other farming practices like weed control, proper preparation of the land, fertilization if necessary, all help to ensure that the water then applied to the growing crop will be efficiently used.

Jack Brewin, an active irrigation farmer and chairman of the St. Mary River Irrigation District, stresses that modern farmers are very conscious of water efficiency and very technical in their approach to agriculture. With large capital funds invested in equipment, and high energy costs, farmers are very careful.

"If one farmer sees his neighboring farmer abusing the system, he's going to tell the district," says Brewin.

The farmers, he feels, have actually been more progressive than the district in his 26 years as its chairman.

"We've had a hard time keeping up with them. I'm proud to be an irrigation farmer today and to represent people who try hard to be efficient and to make the best use of land and water."

Muriel Stringer

New Ways With Water

Innovations are efficient — but expensive.

Alberta Government Photo

Air may be free, but water in many parts of the world certainly isn't. Making sure there's enough water in the right place at the times when it's needed is no easy task, and some solutions to water distribution problems carry large costs which aren't always obvious.

By reducing the wastage of water and the amount of manpower needed to run the equipment, some of the more recently devised irrigation methods do help to keep down the cost of maintaining an adequate supply. But apparent savings in manning the system have to be balanced against the expense of installing it and the amount of energy needed to run motors, pumps, or other machinery involved. No one method of irrigation can be regarded as the universal answer to water shortage, and many alternatives are being studied in Canada, the United States, and Australia.

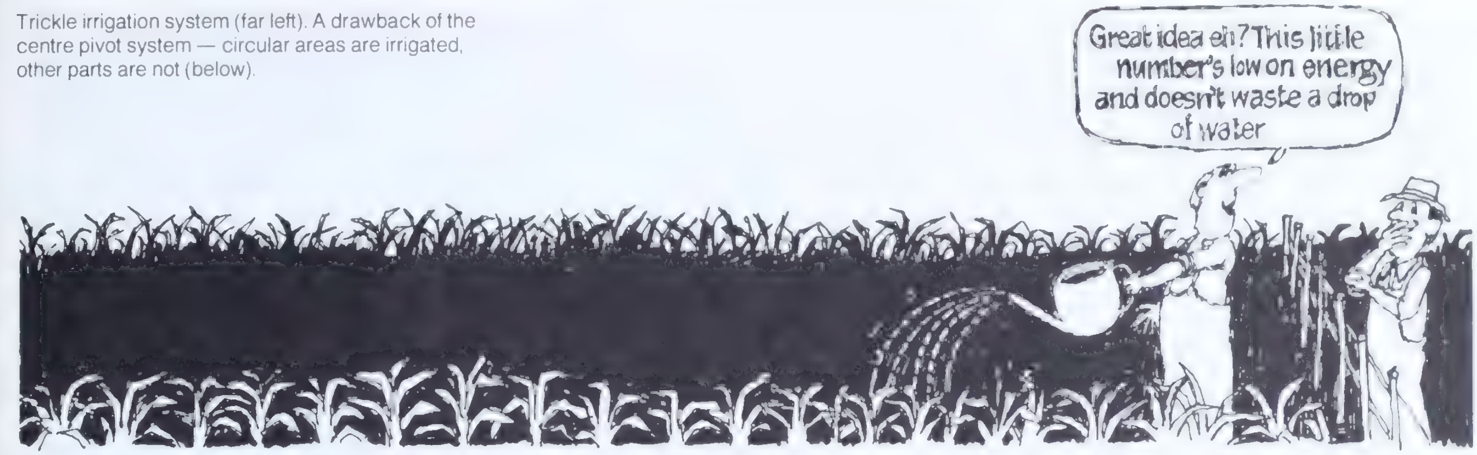
Larry Spiess, an engineer with the irrigation division of Alberta Agriculture in Lethbridge, is currently running a number of experiments on the automation of water supplies to farmland.

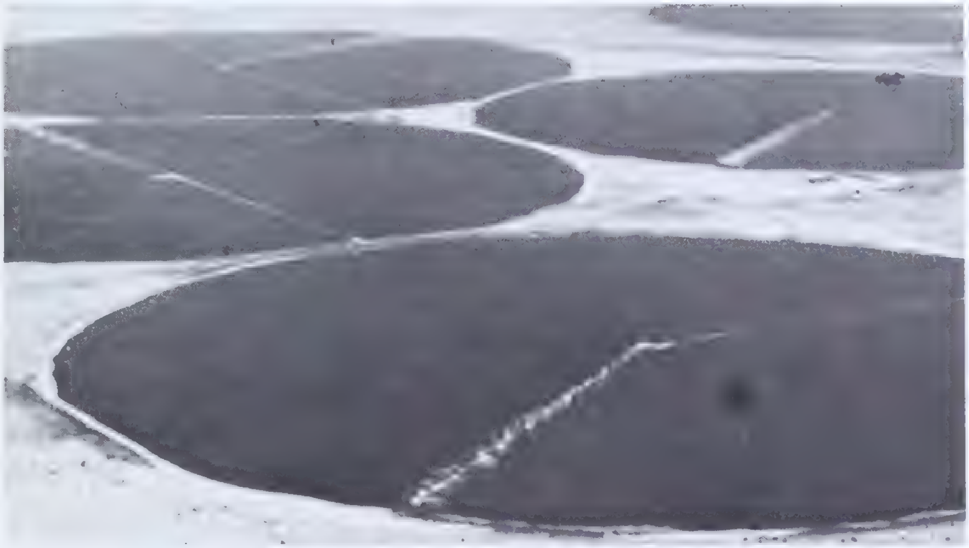
"They're all 'surface automation' systems," he explains. "Basically, this means using timing devices that activate trip mechanisms to allow water to pass through certain parts of a ditch system at some times and not at others. Every so often along the ditch, there's a set of side channels so you can use the clock setting to control the supply to any particular area."

One of the pilot tests on surface automation is being run at Vauxhall, and the other near Lethbridge on a 4.8-hectare demonstration plot. So far, it's impossible for any accurate estimate of the cost to be made but Spiess points out that the equipment is simple and could mostly be made by the farmer himself.

For such a system to work, however, the land has to be levelled, and, while no manpower is needed to operate the controls, the open ditches do have to be periodically cleared of weeds and silt. Then, too, the ditches occupy agricultural land that could be used for raising crops.

Trickle irrigation system (far left). A drawback of the centre pivot system — circular areas are irrigated, other parts are not (below).


Great idea eh? This little number's low on energy and doesn't waste a drop of water



"Surface irrigation has been taking a bit of a back seat," Spiess acknowledges. "But one factor in its favor is the increasing cost of energy. This type of system doesn't need an outside energy supply to run." (See the story on Page 27 for more on energy costs of irrigation.)

In a somewhat more sophisticated style of automated surface irrigation, the open ditch is replaced by pipe from which supply lines lead off at intervals. Flow to the lead-off pipes is controlled by valves regulated by solid-state timers.

"We're just setting up one of these closed systems at Purple Springs community pasture to irrigate about 24 acres (10 hectares). It's going to be a lot more expensive than an open ditch set-up, though. The four valve-timer units alone cost about $500 apiece — they have to be brought in from Nebraska."

Along with the 38-centimetre-diameter piping needed, the equipment for the Purple Springs project should cost around $13,000, Spiess reckons.

A lot less expensive system, the so-called "gated pipe," is already in operation at Bow Island. Here, the water is delivered via a control pipe with a series of "gates" along its length that slide or screw open to control the supply to adjacent areas of the land. Such a system is especially useful in fields with furrows which help control the flow of water over the soil. The main supply line may be on the surface or buried — cost of a buried system is from $375 to $750 a hectare.

Trickle systems have also been studied for several years by the irrigation division but Spiess believes they're too expensive for most agricultural purposes, although they are very useful in areas where water is extremely limited.

"A trickle supply comes from a set of small pipes, about a half-inch (just over one centimetre) diameter, with one going down every row of plants and providing a small amount of water just where it's needed. It's a very efficient way to distribute and conserve water but the cost of installing the eqipment would be too much for any large-scale outfit such as a farm."

Nurseries, greenhouses, shelter belts, gardens, small fruit operations, and orchards are all suitable for trickle irrigation, and some landscaping companies in Calgary have already used such methods.

Costs can vary widely but a rough minimum estimate for piping is about 18 cents a metre. A homeowner, Spiess suggests, could install a trickle system to irrigate a 180-square-metre garden for $50 to $75.

"Lawns would be good to irrigate this way. There's a lot of water wasted with your regular sprinkler because of uneven distribution and spraying of concrete surfaces such as sidewalks, driveways, and patios. With a set of trickle pipes, you could simply lay the whole thing out over the surface and take it inside again in the fall. Of course, you could bury all your pipes, too, — about six to eight inches (about 18 centimetres) is deep enough. But however you choose to set it up, a trickle system's main advantages are the evenness of the distribution of water and the lack of waste. It has a great potential in urban areas which we haven't even begun to tap in Alberta."

Sprinkling is probably the most familiar form of irrigation of all but there are many variations on the simple spraying devices seen on home lawns. Len Ring, an irrigation systems engineer with Alberta Agriculture, specializes in the study of sprinkler systems.

"Generally, there's less waste with a sprinkler than a surface system," he explains. "With a surface system, you might, for example, get a stream of water just running over the top of the land and collecting at the end of the field."

The earliest type of sprinkler, the hand-move, consisted of a length of aluminum pipe with a sprinkler head in the middle. After irrigating one area, the farmer had to move the pipe to the next by hand. Somewhat similar is the wheel-roll, but here the pipe is set on wheels and a gasoline-powered engine in the centre makes movement much easier. Wheel-roll systems are still widely used but are being superseded by the more recent centre pivot system.

"This has been called the most dramatic innovation in agriculture," says Ring. "To look at, it's just one long pipe that rotates round a central tower about nine to twelve feet (three to four metres) above the ground. The tower in the middle of the field is fixed but along the pipe at intervals of about 100 to 180 feet (30 to 55 metres) are other towers with wheels on the bottom. The water is pumped up into the pipe which acts as the sprinkler."

Some of the best features of the centre

Travelling volume gun (hose drag type), above.

pivot system are the uniformity of the sprinkling, the lack of labor needed to run it, and the capacity it has for use on rough ground. Because the pipe is travelling well above ground, even tall crops are not damaged — a distinct advantage over the wheel-roll. Also, the water supply can be easily changed by altering the speed at which the pipe moves.

At $875 to $1,250 a hectare to install, a centre pivot set-up is, however, almost twice as expensive as a wheel-roll and needs much more energy to run.

The first centre pivots were used in Colorado in 1952, and most of the equipment is still made in the United States although there is one small manufacturer in Swift Current. Despite the inconvenience of importation, centre pivot systems are on the increase in Alberta. Since the first installation near Bow Island in 1961, the number in the province has risen to over 1,000.

But the greatest shortcoming of this method of irrigation is the pattern of the spread — fields are usually square or rectangular whereas centrally pivoted sprinkler pipes cover only a circle within the square.

Ring suggests several ways to overcome this problem. One possibility is to plant the corners with crops such as hay, that don't need irrigation.

"Or the farmer might put up a building in that part of the field. Sometimes, too, he just keeps the land free of weeds, though that's a waste."

Some centre pivots do irrigate the corners with a radio-controlled attachment on the pipe that swings out to give the extra length when it's needed.

Another modern method of spreading water through large-scale sprinkling is the travelling volume gun. This shoots out a spray of water under high pressure from a large sprinkler head moved across the field on a motor-powered carrier. Most travelling volume guns simply drag the whole length of their supply hose behind them, but in the past two years some European companies, notably in Austria and Denmark, have devised a variant in which the hose is reeled up and paid out as the gun moves along. Already, one Austrian company has set up a branch in Alberta to import reel-type travelling volume guns and is also preparing to manufacture its own.

The main advantage in this system is its capability to irrigate any shape of field. But the gigantic "water guns" are more expensive than central pivot equipment and, because of the high pressure needed to spray water at more than 300 U.S. gallons a minute, consume a great deal of energy.

Canada, says Ring, is very active in irrigation research but each problem has to be looked at separately and there is no ready answer to give the individual farmer.

"Some systems are fine for one situation, but may not be much use in another. On clay soil, a surface system will do a good job but you have to go to some kind of sprinkler if the soil is sandy. Even on a single farm, you may end up using several different methods. You always have to look at a whole set of pros and cons before you can come up with any kind of answer on the best and most economical way of irrigating the area."

Muriel Stringer is a freelance writer living in Edmonton.

Sharon Adams

The Energy Factor

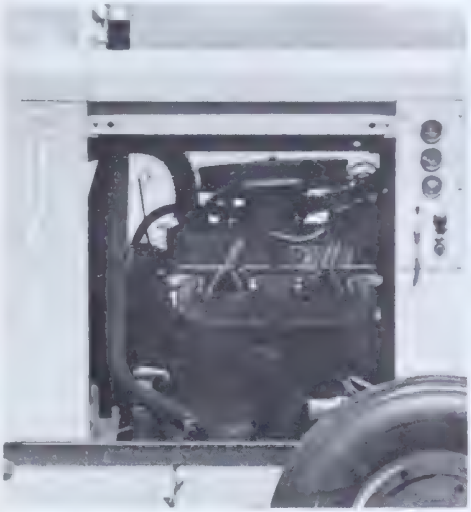
Fuel costs are making farmers think twice about the sorts of irrigation systems they install.

Southern Alberta is part of the Palliser Triangle, a vast prairie stretching south to Texas, an area touted as a bread basket in wet years.

But during dry years the Palliser Triangle can contain pockets of desert, with grain production dropping off drastically. Water here has always been the answer, if not in showers, then from irrigation.

Originally farmers diverted streams and dug irrigation ditches to flood the land, a large investment in labor and only available to those whose land was lower than the source of water.

But with cheap energy, pumping systems to raise the water were developed and many farmers turned to sprinkler systems, which required less work and allowed more land to be farmed.



Today about 400,000 hectares of Alberta land are being irrigated, half by time-honored gravity systems and half by sprinkler systems.

Len Ring, an Alberta Agriculture irrigation systems engineer in Lethbridge, says much more land could be irrigated, but it's an expensive proposition to install sprinkler systems and not all land can be irrigated with a gravity system.

"In the U.S. energy is the main limiting factor in irrigation," he says, adding as energy costs go up here, the same will likely be true of Alberta. So research is being done on ways to cut the energy costs of sprinkler irrigation.

Ring explains there are two basic types of sprinkler irrigation. In the wheel roll system, aluminum pipe, up to half a kilometre long, is mounted on wheels and water is forced through the pipe and sprinkler head by an engine. When the farmer wants to move the sprinklers, he uses a gas-powered unit to roll it along.

In the centre pivot system, a pipeline is suspended from between seven and 20 towers spaced 27 to 54 metres apart. The pipe is anchored at one end and pivots around the tower, moving continuously. The system is moved either by a small motor, usually electric, or by water pressure, but the amount of energy needed to turn the pipe accounts for only about 10 per cent of the total used.

In both systems the primary energy user is the pump which pushes the water along. It requires between 70 and 100 pounds per square inch pressure to get the water to the sprinkler head, where it's broken into droplets which will not harm the crop.

Ring says research has already produced spray nozzles and low-pressure sprinkler

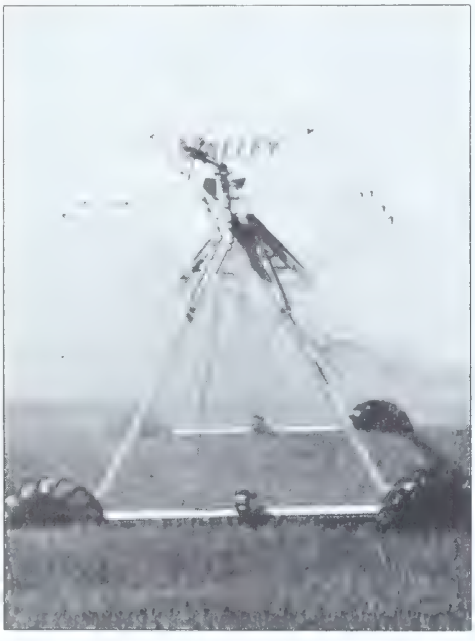
A windmill of the type suitable for small projects in Alberta

heads which reduce the energy requirement by 30 to 40 per cent — and hence the size of the pumping engine.

The use of larger pipe, capable of operating at a lower pressure and requiring a smaller pumping engine, has also cut some farmers' energy costs.

But currently a sprinkler system's natural gas pumping engine can still consume between 1 and 1.5 million cubic feet of gas per year.

Lorne Smith owns a 925-hectare mixed farm east of Champion, of which 192 hectares are irrigated by a sprinkler system.



"I installed the sprinkler system with the costs involved three years ago. Fuel used to cost $600 per circle but now it costs $1,000 (for the pivot system to make one revolution, putting one inch of water on the crops over a period of four days).

"It's costing me $10,000, up from $6,000, for fuel to irrigate."

Energy costs have also colored farmers' attitudes to the irrigation-related practice of drainage.

Drainage is frequently necessary to lower water tables and prevent damage from salinization. But the high costs of electric pumping have often caused farmers to back off in the past, says Brent Paterson, head of the drainage section of Alberta Agriculture's irrigation division.

In co-operation with an individual irrigation farmer near Calgary, and the St. Mary River Irrigation District, the division is planning to monitor the effects of two wind-powered pumping units.

Paterson says the units have a pumping capacity of about 50 gallons a minute, and "as far as we know" are also efficient in periods of low wind. "It looks like they will be extremely viable."

Next spring, Alberta Agriculture will begin testing the efficiency of pumping plants, another method that could cut energy costs, says Ring.

"Perhaps by overhauling a pump, efficiency can increase by 20 to 30 per cent. It doesn't take long for repairs like that to pay for themselves."

Although gravity systems don't use as much energy in operation, they use more water, and much more labor has to go into the preparation of the land and operation of the system. Also not all land is suitable.

Larry Spiess, an irrigation systems

The fall of water through irrigation structures may have potential for hydro generation.

Andrew Vaughan

specialist with Alberta Agriculture in Lethbridge, says 50 to 60 per cent of land is suitable for gravity irrigation.

"The land must be lower than the water source. The energy costs come in land preparation (level grading) and the cost of constructing the ditches."

The costs can range widely, depending on how much preparation work must be done, and how sophisticated a system is desired. If a farmer chooses automated structures, "the cost of construction is considerably higher."

Still, the cost of operation is much lower. Though simple flooding of the land is still done, Spiess says if gated pipe systems are used, they require a maximum of 10 pounds per square inch to operate — energy gained in the simple fall of the water from a higher to lower level.

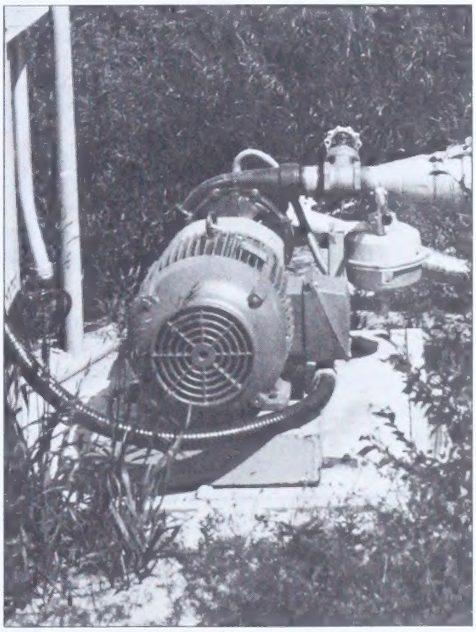
In fact, the energy available from the simple fall of water through an irrigation chute could be used by power companies for hydroelectric generation.

Jim Yu, a senior engineer with the Energy Resources Conservation Board, co-authored a report in 1978 which examined the prospects for a "typical" structure, the Raymond irrigation chute, which drops 29 metres, with a flow of about 2,600 cubic feet per second (73.6 cubic metro/seconds) while it operates from April through October.

Yu says the potential for hydro power is determined by the amount of flow and the drop in elevation. The Raymond site, with some upgrading, has a capacity of 56 gigawatt hours per year.

"In the past because fuel costs were relatively low, it was cheaper to buy from a power company, but now when we calculate the costs of electricity generation from gas and coal, this becomes economical."

He says that for an investment of $10



Alberta Government Photo

million, the Raymond chute could accommodate an 18-megawatt generator, which "is not too big from the provincial point of view, but is large as a local power source."

He said there are "numerous" such sites scattered throughout the southern irrigation districts. Developing these sites would be good "from an energy conservation point of view because that power used would not have to be made by burning fuel." Also, it would cut the cost of transmission because the power is generated closer to where it is used.

Sharon Adams is a journalist in Calgary.

Maryhelen Vicars

Building Dams And Fixing Ditches

These are among the scenarios for the future.

In 60 years irrigation has transformed 400,000 dusty hectares of southern Alberta into lush farmland. What's in store for the next 60 years and beyond?

Farmers who now have part of their farms irrigated are clamoring for more water; many dryland farmers would like to change over to irrigated crops and the large vegetable processing industry based in the Lethbridge area is projecting a steady growth.

Despite this ready market for their "product" most irrigation districts have a moratorium on new connections into their water distribution systems and have a backlog of applications for service.

Under longstanding interprovincial agreements, Alberta must tap only 50 per cent of east-flowing rivers, leaving the rest for Saskatchewan and Manitoba consumers.

For a variety of reasons, we are now taking much less than our share of the Oldman and the Bow rivers and their tributaries.

The two river systems make up the South Saskatchewan River basin where most Alberta irrigation projects are concentrated.

Peter Melnychuk, assistant deputy minister for environmental engineering support services with Alberta Environment, explains: "To use our share we have to have it when we need it.

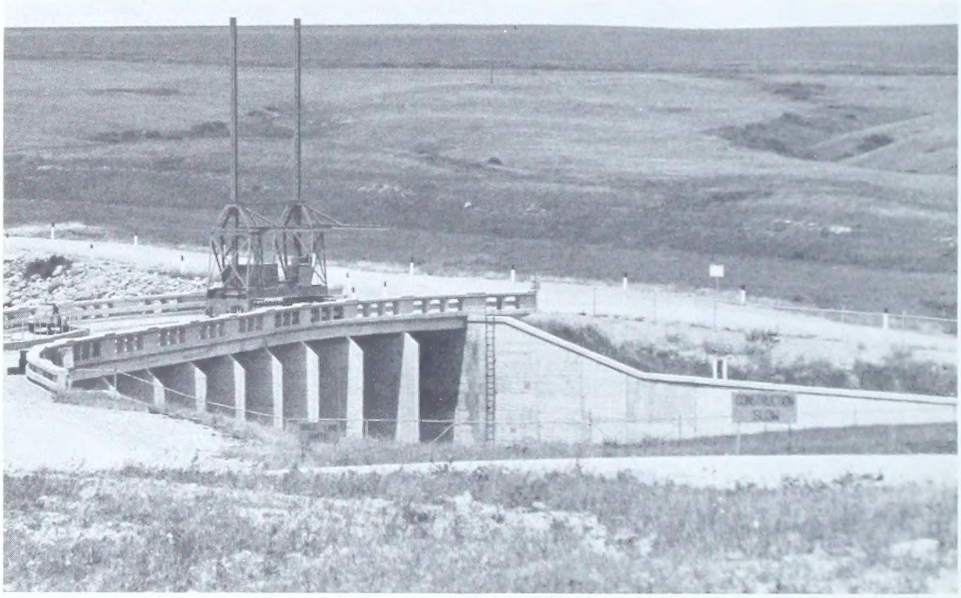
"Because all the waterways (in the south) have very steep gradients from the eastern slopes and because of the climate the water flashes through Alberta very quickly in the spring.

"In about six weeks the bulk of our water is gone. We don't need water in May, we need it in July and August."

The answer to this problem, he says, is storage: capturing part of the massive spring flow and retaining it until it is needed.

Offstream storage is provided in many irrigation districts by diverting water from rivers and streams into local holding ponds which can be tapped as water is required throughout the growing season.

Once captured, the water must be distributed by means of canals and ditches to the fields where it is needed.



Andrew Vaughan

The present storage and distribution systems are only about 40 per cent efficient, Melnychuk says, wasting water through leaky equipment and seeping canals and ditches.

It is Alberta government policy to invest in the improvement of these systems. In 1975 $200 million of Heritage Savings Trust Fund money was allocated to such rehabilitation.

Cy McAndrews, assistant deputy minister for development for Alberta Agriculture, says half this money has been spent but less than half the rehabilitation has been completed.

More needs to be done in this area to make better use of the water that is available, but McAndrews says it would be difficult to say just how much more money must be spent.

Melnychuk points out the three essentials for irrigation: land, water and money.

Of the three, land seems to be the most abundant, with a potential of some two million hectares of irrigable land in southern Alberta. With widespread rehabilitation of existing systems, he suggests doubling the present area to 800,000 hectares, is possible.

As well as repairing and expanding offstream storage, the government is considering more onstream storage, using a dam and reservoir to accomplish the same aim as holding ponds, on a larger scale.

An announcement is expected shortly about whether a large dam will be built on the Oldman River which is not now regulated. Three potential sites would provide onstream storage of between 245,000 and 400,000 acre/feet.

The decision about the dam will be part of a major government decision on water resource development and expansion of irrigation in southern Alberta, Melnychuk says.

Other options include development of offstream storage sites, and continuing investment in the rehabilitation of existing systems.

"One of my fears is that they will go ahead with the dam," says Dr. Arnold Platt, chairman of the Environment Council of Alberta panel which conducted public hearings on water resources management in the Oldman River basin in November, 1978.

"The money would be far better spent on rehabilitation . . .

"It's not very spectacular to fix ditches — but it's much more useful."

Alberta Environment crew repairing a canal in the Fort Macleod area.

St. Mary Dam (left).

Andrew Vaughan

The estimated 800,000 hectares which could be irrigated by means of improved efficiency, better offstream and onstream storage is probably an upper limit for the 50 per cent of the South Saskatchewan flows Alberta is allowed, Melnychuk says.

When that limit is reached, he says, further expansion in irrigation will have to come from transferring water from other basins, from the North Saskatchewan or even the further north Pembina and Athabasca.

"But we have a lot to do before we get to that point. If you look back to see how long it took to put one million acres under irrigation . . . How long will it take to put the next million acres in?

"If and when that point is reached, the government will have to make a major policy decision: to hold irrigation at the two-million (800,000-hectare) level or to move some surplus water from north to south."

The prospect of interbasin transfer is a far-future scheme. But already it's a controversial one.

Present government policy calls for maximum use and development of irrigation within basins, but Dr. Arleigh Laycock, professor of geography at the University of Alberta, says there is already considerable political pressure to have this policy changed.

Laycock says one of the chief deterrents to interbasin transfer would be its cost. At present interest rates he estimates the cost of such projects would exceed their benefit at a ratio of 10 to one.

But a benefit-cost analysis may underestimate long-term benefits to the economy of the region, he says.

The environmental costs would also be high. Increasing the flow in southern channels would cause greater erosion of the riverbed and in some cases alter the course of the river or stream.

Fish and wildlife would be affected and there would be social costs as the large canals and dams would be disruptive to the communities they pass through, Melnychuk says.

Laycock says there could be some potential environmental benefits as well as costs, if transfer projects are designed to serve more than just an irrigation function. An increased flow of spring snow-melt water through ponds and lakes could help flush out algal growth and improve their potential for recreation, for example.

Melnychuk says much more research on the issue would have to be done before interbasin transfer could be seriously considered. He says a 1971 Prairie Provinces Water Board study considered only engineering feasibility, not economic, environmental or social aspects.

"But this research can't be done without government direction. We would almost have to have a change in the policy in principle."

"There's no easy answer to this," Laycock comments. "I'm afraid the decision is as much political as anything. If enough people in the area put enough pressure on the government for development, it will be developed."

Laycock says he is concerned that interbasin transfer should be considered as one tool in a system of water management, that the alternatives of greater efficiency and improved local storage be explored fully rather "than just look at piling on a large amount of extra water."

"The problem is," he warns, "if you turn the engineers loose on this they'll want to transfer much more than necessary.

"If given a free rein, they could create a monster with greater transfer from further north than necessary and at greater expense."

Maryhelen Vicars is a journalist in Edmonton.

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Environment Update

Gas Plant Planned

Phillips Petroleum Company, Western Hemisphere, has announced plans for a gas processing plant at its Ghost field, near Morley, west of Calgary.

An environmental impact assessment is being carried out for the company, and three public meetings held to discuss the plant plans with local residents, many of whom own cottages at Ghost Reservoir.

Citizens' concerns include the possibilities of odor and acid rain from the plant, and possible problems of transportation of liquid sulphur.

Study Notes Noise Problem

An Edmonton study has found that some 130,000 people in the city live adjacent to arterial roads and are being exposed to noise levels ranging from 50 to 75 dBA Ldn (decibels equated on averaging day-night level).

Of those, some 51,000 are being exposed to more than 65 dBA Ldn.

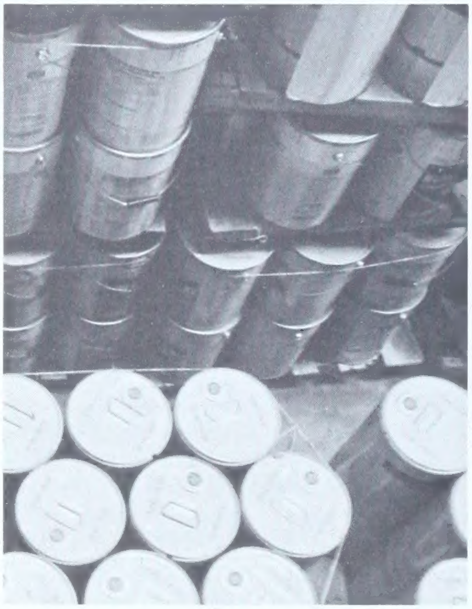
"Health effects consist of long-term hearing damage, prolonged sleep interference and bodily stress leading to various physical and emotional problems," says the report on the study.

The consultants who carried out the study estimate that to bring noise down to the 55 dBA Ldn recommended by the U.S. Environmental Protection Agency and Edmonton's board of health, it would cost $37.5 million for sound barriers — which would completely or partially protect only one-third of those affected.

Company, Residents To Meet

Citizens' concerns about air quality and noise from nearby industrial operations are being clearly illustrated now in northeast Edmonton, where residential development has been allowed to extend to the bank of the river opposite the Celanese Canada Inc. operation.

The company and the Edmonton Federation of Community Leagues are planning public meetings in the fall to discuss the problems. Meanwhile Alberta Environment has asked the company for an air quality impact assessment.



Andrew Vaughan

Container Disposal Studied

Alberta Environment's pesticide chemicals branch, assisted by the waste management branch, is winding up a pilot study aimed at developing recommendations for the collection and disposal of used pesticide containers.

A selection of municipalities across the province, as part of the study, set up collection sites; local agricultural service boards advertised the service to farmers.

Containers collected at the sites have been crushed, and will be stored at suitable landfill sites over the winter, while the report and recommendations are completed.

Testing Worries Mayor

Medicine Hat Mayor Milt Reinhardt has asked the federal government for assurances that city residents are not being endangered by atmospheric testing, including possible biological warfare testing at nearby Suffield military experimental range.

The mayor was concerned about a national defence department report which confirmed that the testing of toxic biological warfare agents was carried out at the range during the 1940s and 1950s. However the department has said agents were never used in atmospheric tests which could have affected the public.

Workshop Scheduled

The Banff Centre school of management will run its sixth environmental impact assessment workshop Sept. 13 to Sept. 20.

The workshop, which will feature major hydro development, is designed for project engineers, environmental co-ordinators, review board officers, administrators and consultants involved in the planning, design and management of major industrial and resource developments in North America.

The focus will be on the need, purpose, execution and limits of environmental impact assessments of major projects in Canada.

Transmission Line Recommended

The Energy Resources Conservation Board has just recommended approval of an application by Calgary Power to build a 500-kilovolt transmission line between Calgary and the British Columbia border. The transmission line, with a similar one in B.C., will link the power grids of the two provinces.

Approval by the minister of environment and cabinet is still needed before the project can go ahead.

If you have a short news item of province-wide interest you'd like to contribute to Environment Update, please send it to the editor at the address on the Contents page. The editor reserves the right to select and edit the items.